Understanding the Location Choices of Logistics Firms

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Distribution, warehousing and logistics facilities located in Canadian municipalities have significant impacts on surrounding land uses and on nearby transportation infrastructure, not to mention the broader socio-economic environment. While there is considerable literature available concerning the location choices of generic industrial firms, explorations of logistics firms' locations have been less extensive. This is somewhat surprising because of the increasing 'footlooseness' of logistics firms and the potential issues surrounding their activity, for example related to the amount of freight traffic that they generate. There is a need for the public sector, including planners and economic developers, to better understand the requirements of the logistics industry in order to accommodate these firms while mitigating potentially adverse impacts to communities.

The goal of this thesis is to identify and assess the relative importance of factors that influence the location choices of logistics firms in a municipality, and to identify potential issues of operational conflict between municipalities, their residents, and logistics firms. A web-based survey of logistics professionals has been carried out to help address this goal. Semi-structured interviews were then undertaken with participants who completed the survey and indicated an interest in further participation in the study. Overall, 42 completed survey responses were received, and 10 follow up phone interviews were conducted.

The ability to operate 24/7 was reported as one of the most important location factors in addition to land costs, proximity to transportation infrastructure, and access to a skilled workforce. Transportation infrastructures such as rail intermodal facilities and airports are seen as important regional considerations but close proximity is not important on a site specific level. Through interview results participants indicated problems with parking bylaw requirements, and operating restrictions during the nighttime as challenges related to their specific location. Results confirm general understanding of what drives location choice for industrial firms, but the additional necessity for a robust operating environment for logistics firms highlights the need for planners to pay particular attention to the specific requirements of this important economic sector.

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LIST OF ABBREVIATIONS

3PL	Third Party Logistics Provider
AHP	Analytic Hierarchy Process
CD	Census Division
CIFFA	Canadian International Freight Forwarders Association
CMA	Census Metropolitan Area
CSD	Census Subdivision
DC	Distribution Centre
DTS	Direct To Store
GDP	Gross Domestic Product
GGH	Greater Golden Horseshoe Area
GTA	Greater Toronto Area
GTAH	Greater Toronto and Hamilton Area
JIT	Just-In-Time logistics
LCV	Long Combination Vehicles
MCDM	Multiple Criteria Decision Making
MOE	Ontario Ministry of Environment
NAICS	North American Industrial Classification System
RFID	Radio Frequency Identification
SCM	Supply Chain Management
SIC	Standard Industrial Classification System
SCL	Supply Chain and Logistics Canada
QR	Quick Response Logistics

1 INTRODUCTION

Throughout Canadian communities logistics facilities exist, mostly hidden within industrial parks that are termed 'employment lands' by urban planners. Accompanying these warehouses, distribution centres and lots containing seas of trailers are large amounts of truck, rail and airport traffic that create a disproportionate burden on nearby residents and communities. Hesse (1995) notes that "there is a rising conflict between functional requirements of freight movement and commercial traffic and significance of the city as a residential and recreational habitat" (p.39).

The importance of this industrial sector cannot be understated. Economically, the logistics industry contributed just under 10% to the Canadian Gross Domestic Product in 2005 (Statistics Canada, 2010), and 1.9 million Canadians were employed by businesses relating to transportation, warehousing, and wholesale trade in 2008 (Statistics Canada, 2008). Apart from economic considerations, all goods that have been purchased by Canadians have spent time travelling through the supply chains that are centred around logistics facilities; and the maintenance of goods flows is essential to maintaining food, health, and all the goods that we rely on in our daily lives (McKinnon, 2006). Despite the importance and impact that the logistics industry has upon the lives of Canadians, it is surprising the urban planners have largely ignored planning for logistics facilities, and indeed provincial and municipal planners themselves report to have little knowledge and no training on freight related issues (Woudsma, 2001; Haider, 2010).

1.1 Logistics Industry Description

Before discussing how changes in the logistics industry affect facility locations, the variety of firm roles and functions within the supply chain will be described through an example, to give background to those readers who are not familiar with the logistics industry. Consider the case of a miller that mills flour. This miller purchases wheat from a farmer or a farmer's cooperative, who will deliver the raw wheat to the mill. But the farmers do not actually own the railway that brings the flour to a terminal which is close to the mill, and the farmers do not own the truck that brings the wheat from the railway terminal to the milling facility. They 'hire'

transportation companies that perform these tasks, and the mill pays the farmers who pay for, or 'hire' the transportation (in this case the wheat changes ownership upon delivery).

The wheat is milled into flour, and the miller owns trucks that will deliver this product to its customers, large and small retailers or wholesalers/distributors who will resell this product again. Some of these retailers have their own distribution networks, in which case the miller's own truck will deliver the product to its customer's distribution centre or warehouse. In other cases, it is possible that the miller will deliver its flour directly to the customer's store for final sale. Because these are the miller's trucks, in addition to being a miller, the miller is also a 'private carrier.' Typically, the miller's trucks do not perform deliveries of other company's goods. Also, consider that the miller can produce enough flour efficiently in one facility to serve the entire Canadian market. The miller's trucks do not have the capacity to serve remote markets. So the miller will hire a transportation provider such as trucking company and a public warehousing firm which will each perform various distribution functions for the miller in the remote markets. Or the miller can hire a 'third party' to perform all of these functions. This type of business model is called the Third Party Logistics provider (3PL). And 3PLs do not only perform supply chain functions in remote regions, but the milling company may divest themselves of their own private fleet of trucks, and ask the 3PL to perform these functions locally as well. Additionally, a 3PL may assume responsibility for the transportation of raw wheat to the mill for the farmers, which may or may not be the same 3PL firm. This is a generalization of the types of business models that exist within the logistics industry today.

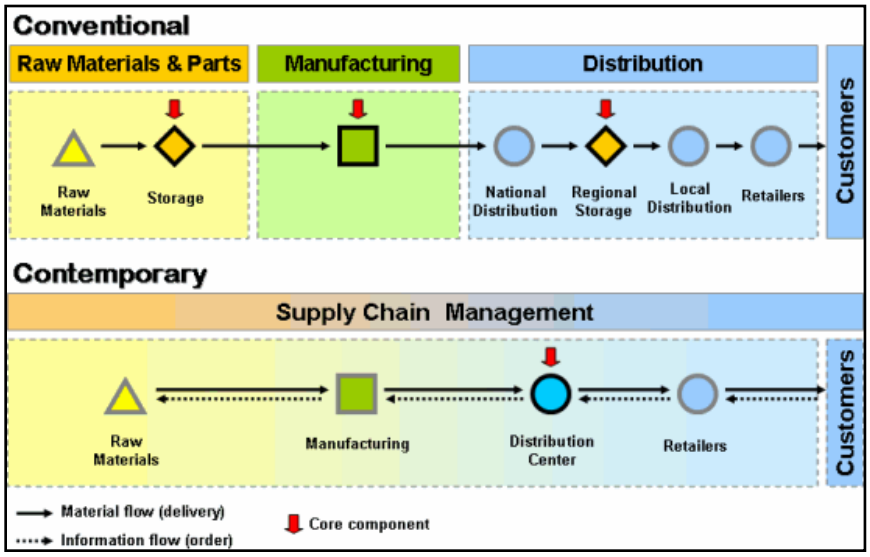
This example shows the complexity of the relationships between supply chain stakeholders. The affects of this complexity have impacts upon the facility siting process, and ultimately, the location choices of logistics firms. The different types of businesses described here, for-hire or private carriers, railways and 3PLs, will all have slightly different operating environments and requirements, but they will all share priorities in siting their facilities unique to logistics firms. The ultimate locations of logistics facilities will have impacts upon the surrounding communities as well as implications for economic development.

1.2 Contemporary Supply Chains

Embedded within the business relationships are changes that have occurred over the recent past in supply chain practices and these changes must be reviewed to understand the reasoning behind logistics' firms location decisions. Logistics firms operate within the context of contemporary supply chain management strategies, the business practices that guide the delivery of goods from producer to consumer. Through the late 1980s and into the early 1990s, the adoption of the Japanese system of Just-In-Time production (JIT) had an influence on the makeup of the freight transportation system in North America. In the 1990s, Quick Response (QR) strategies were implemented first within the apparel industry, and then amongst other types of retailers (Finne & Sivonen, 2009). Wal-Mart has been part of these changes and is known for implementing cross-docking throughout its stores, better communication with its suppliers through Vendor-Managed Inventories, and more recently increasing the use of Radio Frequency Identification (RFID) technologies (Urban Land Institute, 2004). Because of the increasing use and availability of information technologies, the application of JIT and QR principles, and the fragmentation of production, the amount of freight moved has increased more rapidly than growth in the GDP (Rodrigue, Comtois, & Slack, 2006).

Within the introductory example, the existence of the 3PL business model was introduced. This business model emerged through the 1990s along with the growth of supply chain management as a process for integrating logistics into the production method. These companies have emerged to manage the supply chain of manufactures and other shippers who have contracted out their entire supply chain due to its increasing complexity (Hesse, 2008; Rodrigue et al., 2006). This change is depicted in Figure 1-1.

Figure 1-1: Conventional versus Contemporary Supply Chain



Source: (Rodrigue et al., 2006)

The land use implications of these changes are significant. The structures of logistics facilities have changed substantially to accommodate the needs of the contemporary supply chain. JIT has also been seen to promote the use of road transport over that of rail. Because of the time-sensitive nature of JIT production techniques the use of rail for shorter movements has declined. This is reflected within the modes that serve logistics facilities. While as recently as the 1970s no warehouse would have been developed without rail access, today this is common practice (Urban Land Institute, 2004).

Supply chain management has worked to consolidate logistics facilities. This has resulted in a move towards fewer warehouses that are larger in size and serve markets that previously had their own, smaller warehousing facilities (Canadian Urban Institute, 2000). An example of this is manifest in Wal-Mart's changing facilities in Canada. It has reduced the number of Distribution Centres (DCs) from nine to three over recent years (iTrans, 2004). Additionally, these facilities are taking on different characteristics. A need for more throughput of goods in and out of the facility, and less storage has meant that they require more horizontal space, and 'high cube' building construction, with ceilings typically being 28-38 feet high (Urban Land Institute, 2004). Additionally, cross-docking operations can take place with no storage of goods, as trailers are unloaded and loaded immediately. These types of facilities have a very high ratio of dock doors to floor space. Site plans for logistics facilities in general now

require more space for parking trailers outside, as well as staging areas for waiting until goods are ready to be picked up or dropped off 'just-in-time.'

Facility needs vary based on the type of operation. If the logistics function of the business is its primary function, then characteristics of the facility will be tailored exclusively to the characteristics mentioned above. However, if the logistics function is ancillary to other operations on site, for example manufacturing, then site plan considerations will be vastly different (Canadian Urban Institute, 2000).

1.3 Planning

Trends in how planning is conducted within Canadian communities will have an effect upon how these types of facilities can be supported within urban areas. For example, the prevailing movement among planners today has been to address the problems associated with urban sprawl through 'smart growth' policies to promote healthier, less car-dependent lifestyles. Promotion of communities that focus on the 'new economy' of high-tech and creative industries generally disregard the role of logistics firms. New urbanism has been proposed as a method of increasing densities and bringing people closer to where they work (Skaburskis, 2006). These design standards may function for employment uses that are capable of maintaining a high density of employment, but are not as applicable for employment in sectors such as logistics, which typically have low employee per square foot ratios (Yap & Rene, 2003). The planning focus on mitigating urban sprawl is seen throughout official plans of Canadian communities and regions such as Ontario's '*Places to Grow*' growth plan and is reflective of the general paradigm of intensification (Ministry of Public Infrastructure Renewal, 2006). This plan in particular creates density targets of people and/or jobs per hectare that logistics firms cannot comply with.

These planning trends, along with industry trends for larger and centralized facilities, will likely contribute towards the 'pushing' of logistics facilities from within the urban boundary to suburban and exurban areas. There is evidence that this is already occurring within the United States (Bowen, 2008; Cidell, 2009), and industry observers in Ontario see the same trend occurring here (Donahue, 2007). Furthermore, a hypothesis has been suggested that logistics firms may be 'pioneering' developments in North America (Hesse, 2008). Traditionally, warehousing was a support service to manufacturing, and clustered around areas where

manufacturing was present. Today, this relationship may be reversed, with logistics firms leading the march out of the city with manufacturing firms following their support services to the periphery (Hesse, 2008). If this hypothesis is true in the context of Canadian urban regions, then planners will be encouraging industrial sprawl through their intensification efforts. Freight sprawl is defined here as when logistics businesses move outside of the urban boundary, and when facilities disperse over the urban area. This may result in a misallocation of public resources that provide services to these firms. In the Toronto Area in particular, movement of firms over the greenbelt into exurban areas will also be classified as freight sprawl.

1.4 Justification

Explorations of how location choices of businesses are made follow a long and rich tradition. From Von Thunen's early investigations of agricultural land use to recent correlations of city development to the presence of a creative workforce, understanding the location choices of businesses underlies our desire to understand how and why firms will develop and locate in one country versus another, one city or another. Studies that have examined location choices for generic firms offer a 'shopping list' of attributes and ask which are the most important through modeling their propensity to relocate (Targa, Clifton, & Mahmassani, 2006) or simply describing the most important location factors for relocation (Barkley & McNamara, 1994).

Explanations of logistics firms' location choices have traditionally been seen as the result of minimizing distances between suppliers and customers. This view has its roots in Weber's (1928) hypothesis that a firm's location will be dependent on the relative expense of the transport costs of inputs versus the transport costs of finished products. Contemporary operations research minimizes these costs through the p-median problem, which incorporates more cost variables in order to determine the most efficient site or sites (Melo, Nickel, & Saldanha-da-Gama, 2009). However, within discussions of logistics firm location choices, it has been hypothesized that simple transportation costs based on distance are not a good indication of the total spatial interaction costs that firms face (McKinnon, 1999).

Attempts at creating a 'shopping list' of location factors that are of particular interest to the logistics industry have been few. Sivitanidou's 1996 study of logistics facilities within the Los Angeles area is a notable exception which included transportation infrastructure as well as

access to labour pools. Bowen's 2008 study of the importance of US transportation infrastructure concentrated on the logistics industry using county-level attributes. Investigations with a qualitative focus have taken place in many places around the world, notably Hesse (2008) in Northern California and Berlin, Holl (2004) in Spain, and Warffemius (2007) concentrating on the area surrounding the Schiphol airport in Amsterdam. Within the Canadian context, these descriptions of location factors surrounding logistics firms' location choices have been reported on the Canadian Urban Institute's 2000 study of warehousing and distribution firms in Mississauga, and iTrans Consulting's 2004 study of goods movements in Central Ontario. However, after an extensive literature review, no attempts at identifying the relative importance of location factors for logistics firms within Canada were found. In general, there has been an increased interest in goods movements by urban planners. Within Ontario the creation of a new regional transportation planning body named Metrolinx, along with specific goods movement plans being undertaken in Durham, Peel and York are indicative of this increase in interest. In spite of this, it has been argued that planners generally have a lack of knowledge about how the logistics industry operates, and how to incorporate these operations into the planning process (Haider, 2010).

This thesis will begin to address some of these gaps in understanding, and will be useful for a number of groups. First, within academic literature this is the first attempt to classify location factors influencing logistics firms within Canada. For urban planners, this thesis identifies issues surrounding logistics firms as they relate to both land use and transportation planning, and findings could be incorporated into goods movement plans that are currently being undertaken by Canadian municipalities. For logistics firms and industrial land speculators, this study consolidates views of the industry and provides a tool to effectively lobby municipal and provincial governments to ensure more effective operating environments within Canadian communities. For economic developers, this study may help identify what attributes could be provided within a region to accommodate and encourage the development of this important industry.

1.5 Scope of Inquiry

The logistics industry is difficult to define. Logistics facilities will be defined in this thesis as those facilities whose primary function it is to handle freight movements. This includes

truck terminals, warehouses, and distribution centres. The difficulty in classifying firms is apparent when considering that most firms that are involved in the production, movement or are recipients of physical goods are involved in their supply chains to some extent through the operation of facilities and/or their own private fleets. The result is that often manufacturers or retail stores will have space for storing goods before or after shipment to final use. The variety of business models that perform various distribution, logistics and warehousing functions are found within the North American Industrial Classification System (NAICS) classifications of Wholesale Trade (41) and Transportation and Warehousing (48&49) according to Hesse (2008). However, identifying a particular business type is difficult using these classifications; for instance it is impossible to identify 3PLs.

This thesis will concentrate on issues that are related to facility site development and that function at the local scale. Because the scope of operations for logistics firms is often global or national their interests at the local level are often not clearly articulated. The literature on location decisions for logistics firms shows that facility location decisions are split into two separate decision making processes. Decisions on the number of facilities, the general location, capacities and types of operations performed within facilities are termed 'network design', while decisions about the particular location of a facility within a region is termed 'site selection.' (Chopra & Meindl, 2004). The entire process will be termed 'facility location' in this thesis. This work will concentrate on public impacts of site selection and network design, concentrating on regional scales.

1.5.1 Research Questions and Objectives

The general objective of this research is to better understand the location factors for Canadian logistics firms with a focus on the Greater Golden Horseshoe (GGH) (See Figure 1-2). In addition to the aforementioned issues, this thesis will examine the possible impact of a pilot project allowing Long Combination Vehicles on Ontario highways, and whether they may have an impact upon location decisions (Ontario Ministry of Transportation, 2009). The primary research question is:

- What are the location factors relevant for logistics firms in the GGH and what are their relative levels of importance both quantitatively and qualitatively?

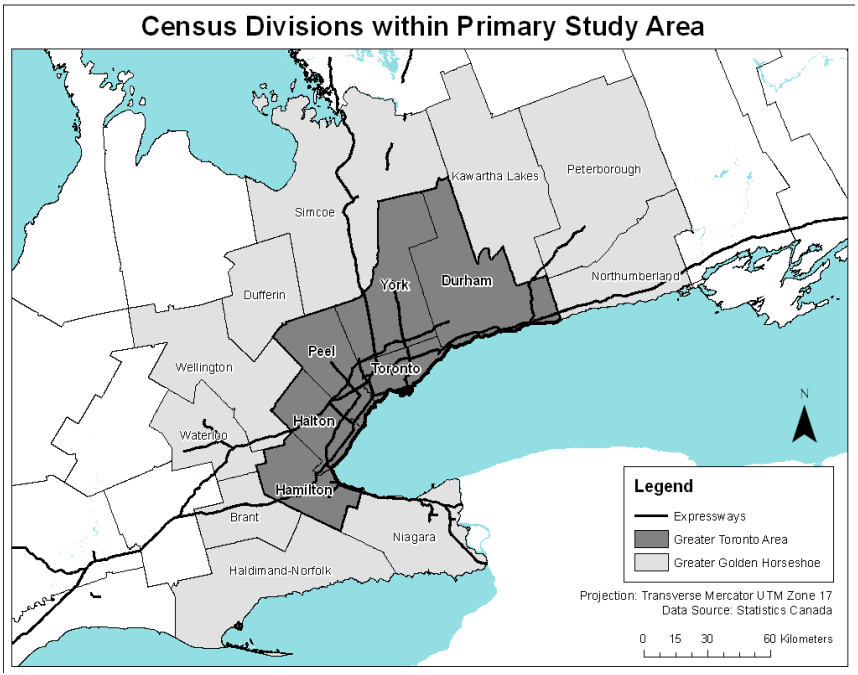
Further questions driving the research are:

- What planning issues are associated with the siting and operations of logistics firms?
- What are the implications of Long Combination Vehicles upon facility locations?

These questions are addressed through:

- Examination of data available through the Canadian Business Patterns Survey, Labour Force Survey, and other Statistics Canada data,
- The administration of a survey of logistics professionals, and
- Interviews with logistics professionals

Figure 1-2: Study Area



1.6 Thesis organization

The first chapter of this thesis introduced the topic, chapter two will present a literature review of both generic industrial firms and logistics firms' location choices. Chapter three will present the methodology used, along with its limitations. Chapter four will present the results of the research, and Chapter five will contain a discussion of these results, and their implications for planners, economic developers and logistics firms themselves.

2 PREVIOUS INQUIRY

Previous research indicates that location choices of firms are the result of a variety of factors. These have been found to include transportation access considerations, the size and nature of operations, and distance to markets and suppliers. These choices are reflective of the process that underpins a firm's site selection, which is governed by two major influences. The most important influence as identified by Hesse (2008) is the geography of the region, what advantages the region has in terms of labour markets and accessibility to both suppliers and customers. Secondly, the micro-level considerations include the size of lot, the land rents demanded and the existence of a 'robust' operating environment where 24/7 operations are available.

This chapter will first examine the development of micro-economic theories seeking to explain the development of industrial firms in general. Then, the location choices of generic industrial firms will be discussed, followed by logistics firms specifically. Literature described here will generally fall into one of three categories of academic inquiry. Firstly, the foundations for much of the most recent work lie in economic geography that began with questions of agricultural land use and then locations of industries generally. More recently, economic theorists like Krugman (1991) have renewed interest in spatial economics.

Secondly, a great deal of current research deals with the location choices of logistics firms in the context of the firm – that is how to best position the facility location in order for the entire supply chain to operate most efficiently and profitably. This class of literature generally comes from operations research, or computer science. While operations researchers develop new models that incorporate a vast array of both qualitative and quantitative variables, simultaneously deliberating upon how these models can work within various decision making frameworks, planners and academics take a different approach.

Planners and geographers often perform studies of the individual actors involved in logistics firm locations but they are often attempting to explain the realized location choices of firms within the context of how these aggregate decisions affect the rest of society. On the other hand, literature found in operations research concentrates not on the aggregate effects of firm location decisions, but upon how the individual firm makes its decisions. This consists of the

strategies and objectives that occur within organizations and how to optimize the firm's operations in the context of the organization's privately driven goals.

This study focuses on the location choices of logistics firms within the context of the broader public domain. In spite of the fact that each individual logistics firm's location is determined by its own corporate objectives, these objectives and goals sit within the context of land and people, which planners and academics spend so much time investigating. While these objectives may appear different, subsequent realized location decisions reflect the fact that they are often quite similar, with few logistics firms in isolation from the broader public context within which they exist.

2.1 Industrial Firms' Location Choices

This thesis concentrates on the location choices of distribution, logistics and warehousing firms. Before addressing literature concerning this specific section, the body of knowledge surrounding more general location factors that have been researched for all types of industrial firms will be outlined. Economic geography has worked to explain the location choices of industrial firms through the development of location theories, grounded in micro-economics. Distribution firms exist within this framework by offering to minimize costs incurred through the movement of goods from the point of production to market. In addition, logistics firms are increasingly performing value added functions to goods as they move through the supply chain (Chopra & Meindl, 2004).

2.1.1 General location theory

Early economic geographers include von Thunen, who worked to explain the use of agricultural lands by identifying the existence of a bid rent curve for differing agricultural products based on their distance to market (Fujita, 2009). More relevant to this thesis is Weber's (1928) hypothesis that a firm's location will be dependent on the relative expense of the transport costs of inputs versus the transport costs of finished products.

Classical economic geography marks the beginning of the pursuit of a general theory of location, which has been taken on by contemporary economic theorists under the heading of 'New Economic Geography,' with an emphasis on understanding the forces of agglomeration of firms. In Krugman's (1991) seminal paper, he shows that a core-periphery pattern can be

modeled through interactions between transportation costs, economies of scale, and the share of manufacturing in national income. Fujita and Thisse (2002) continue in this vein to explain the location of firms through examining agglomerations that are observed in urban areas, and they discuss the role that transportation cost has in creating these agglomerations of firms. A key observation applicable to this work is their observation that firms balance between centripetal and centrifugal forces that pull firms towards cities and at the same time push them away from central areas due to high land prices and congestion.

The literature surrounding the creation of clusters of similar firms is quite relevant to this study, as logistics firms exhibit this behaviour to some extent within the Canadian context (iTrans Consulting, 2004). Proximity to labour and proximity to transportation infrastructures are explanatory variables that are used within the literature of economic geography to give a sense of transportation costs and are also useful in guiding the development of this study.

However, McCann and Sheppard (2003) have criticized the simplifications made by New Economic Geography theorists in the context of the post-Fordist economy. They propose that transportation costs should be changed to incorporate more perceived spatial transaction costs, such as 'total logistics costs' and the effect that JIT production techniques have upon the speed of delivery. This criticism will be incorporated into this study to ascertain whether spatial transaction costs are seen by firms in Canada as simply transportation costs, or whether they are made up by more than this.

Table 2-1: Location Theorists and Theories

Author	Summary	Assumptions	Location Factors
Von Thunen, 1826	Explaining agricultural production around markets	Land quality is uniform Emphasis is on relative location of land use	• Distance to customers (market)
Weber, 1928	Explaining the location of factories by understanding their input/output costs	Factory location will be optimal where input/output costs are minimized	• Distance to customers • Distance to suppliers • Cost of labour
Hotelling (Market area analysis), 1929	Explaining the market area of firms selling undifferentiated goods	Uniform, equally distributed population	• Relative location to market
New Economic Geography: Krugman (1991)	Explaining the growth of a core-periphery structure	Constant agricultural production, mobile labour, specialization in goods in different areas	• Interaction of economies of scale with transportation costs
McCann and Sheppard (2003)	Critic of simplifications inherent in other industrial location theories		• Total Logistics Costs • Different sectors will have varying reasons for clustering

The preceding discussion raises an issue of concern for this study. The scope of inquiry, and therefore potential explanations vary from theory to theory. The focus of this study is on local location factors. While these cannot be totally divorced from the overarching macro-economic situation, evidence suggests that decision-makers do consider different objectives when deciding to locate within a region, compared to the objectives considered when choosing precisely where, within that region, to site their facility.

2.2 Scope of Decisions and the Decision-Making Process

A macro level decision involves choosing whether and how a firm will serve a particular market. The geographic size of a market can vary considerably, and can involve a scope that is multi-provincial or multi-state (Blair & Premus, 1987). Organizationally, this process involves individuals from across the company, who would assemble a team that describe the location that would fulfill their needs, and what qualities they would value in a location. Following this macro-level decision, the firm creates a list of alternative sites that would best fulfill their needs and examine the trade-offs that need to be made when selecting a site. For instance, Barkley and McNamara (1994) asked about the factors influencing a firm's location in the US southeast, and then moved on to determine relevant micro level location factors.

Concerning logistics firms, the scale of what constitutes a regional consideration varies tremendously depending on the type of operation. For example, selecting a hub for airport operations can involve choosing between cities hundreds of kilometres away, which may be considered to be in the same region (Fleming & Hayuth, 1994). Conversely, if the firm must choose where to locate to serve a particular local market (or two), the size of the regional scale shrinks considerably.

While there is a clear distinction between the scales of decision making in the aforementioned literature, within Operations Research literature, it quickly becomes clear that this distinction can be lost amongst discussions of supply chain network design. Operations research concentrates on using mathematics and modeling techniques to solve complex problems. But recently, macro and micro level decision making are being simultaneously incorporated into models that are built to support corporate decision making, often incorporating both qualitative and quantitative factors. According to Melo, Nickel, and Saldanha-da-Gama

(2009) only a few papers have been published with both levels of decision making included in new models.

For instance, optimizing the network design of a firm involved in multi-national operations can involve simply selecting the *cities* that will be used as break-bulk or other value-added operations as in Robinson and Bookbinder's (2007) paper on the formulation and solution of a mixed-integer programming model for locating facilities for a power supply manufacturer across Canada, the US, and Mexico, which are classified here as a macro level optimization exercise. Or it can involve a micro level decision support system as discussed in Vlachopoulou, Silleos, and Manthou (2001) which optimizes a warehouse location within a particular market using pairwise comparisons within a GIS framework.

Finally, a mix of the two decision making levels can be found in Ambrosino and Scutellà (2005) where they model the optimal network for both the location of the site (a macro level decision) while taking into consideration minimizing the routings of vehicles, typically a tactical level decision within the context of supply chain management, and a local level consideration within the current discussion.

There are various methods used to assist companies in making these decisions, along with no shortage of help from operations researchers in utilizing different decision making frameworks. The reason for this interest is understandable; these are complex decisions that are not easy to make, as Chan, Kumar, and Choy (2007) note: "An ordinary decision-maker [can] not handle more than seven to nine decision elements simultaneously without being confused" (p.728). It bears to witness the number of techniques that are at the decision maker's disposal, such as the Analytic Hierarchy Process (AHP), Multi-Criteria Decision Making (MCDM), along with other inputs such as cost-benefit analyses, or life cycle analyses. All of these methods include both quantitative and qualitative elements which have been shown to have an impact on site selection.

2.3 Empirical Investigations of Industrial Firms

2.3.1 Public Sector Oriented Studies

There is literature available that has surveyed firms to ascertain factors influencing their industrial location choices. The studies that will be described here do not focus on a particular

industry, but instead typically describe the location choices of firms located in a particular area (Barkley & McNamara, 1994; Targa, Clifton, & Mahmassani, 2006). Typical findings from these studies include the importance of transportation infrastructure and they highlight that location choices are dependent on the size and nature of businesses. The provision of transportation infrastructure is often the focus of location choice studies as it is an opportunity to provide decision makers with information on how to strategically place infrastructure to maximize its use.

Targa et al. (2006) asked to what extent transportation infrastructure affects a firm's propensity to relocate. In terms of transportation infrastructure, they found that firms with less access to roads that have a higher functional form were more likely to move. Also, other variables found to be significant in this study were the characteristics of the business, and accessibility to regional and local markets. They conclude that there is a positive relationship between economic activity and access to highway facilities. Location factors included in this study are listed below.

Location Factors Used
• Propensity to relocate • Local accessibility characteristics • Regional accessibility characteristics • Agglomeration economy characteristics • Firm-specific characteristics • Business-specific characteristics • Factors influencing a firm's initial business location • Perceptions or attitudes towards regional considerations

Figure 2-1: Location Choice Factors included in Targa et al. (2006)

Barkley and McNamara (1994) assess the effectiveness of surveys investigating the location choices of manufacturing firms and found that regional characteristics influenced larger firms to a greater extent than smaller firms. Also, smaller firms were not likely to have an extensive site searching process. They concluded that disaggregating location factors is required to identify relevant location factors and suggest that case studies may be more useful to pinpoint specific manufacturers' needs. The variables included in their study are described in Figure 2-2.

Location Factors Used
• Skilled labour availability and costs • Unskilled labour availability and costs • Availability of technical training programs • Availability of land for construction and expansion • Availability of vacant facility • Proximity to interstate highway • Proximity to product markets or supplies • Proximity to airport with commercial air service • Proximity to metro area • Adequacy of water supply and waste disposal facilities • Local government incentives/services • Availability of housing • Quality of primary and secondary education • Availability of recreational opportunities/cultural resources • Other

Figure 2-2: Location Choice Factors included in Barkley and McNamara (1994)

Along the theme of transportation infrastructure, Button et al. (1995) conducted an analysis of how transportation infrastructure impacts the location factors affecting firms based on the: origin of firm, size of firm, location of parent company, and attitude to transport links by mode. Interestingly, they find that poor transportation infrastructure does not seem to stimulate firm migration out of a location, but transportation infrastructure provision is a criterion for a new site. Also, they find that there seems to be a difference between intra and inter-regional facility moves. This is not surprising as this difference is likely comparable to the differences in business decisions often referred to as network design versus site selection. Their study surveyed all commercial and industrial properties within the Strathclyde region of Scotland. Kawamura (2001) in his temporal examination of businesses in the Chicago area, found that suburban businesses tended to move closer to freeway ramps, while businesses in the urban core tended to move closer to places with transit access.

Additionally, within economic theory there is a distinction between the stated and revealed preferences for alternatives that cannot be easily evaluated through monetary terms. Leitham, McQuaid, and Nelson (2000) discuss the revealed location choice of a firm as the process of asking a firm about how the current location was chosen, while the stated preference approach considers the location to which a firm would relocate. In their study, a pairwise choice was asked of decision-makers, where they would choose between two alternate sites rather than rank factors according to their importance. This technique was utilized to ascertain the importance of a specific attribute to a firm's location, in this case, the proximity to a highway.

The focus of the preceding studies identify the characteristics of firm location choices so that public sector individuals can more clearly understand the location choices that firms make, and proceed with appropriate investments or to gain knowledge which will help them in attracting businesses to a particular region. The following section will outline studies which approach the problem of firm location in a different light, mainly to identify and improve upon firm location choices so that the benefits of a deeper understanding of firm location choices will accrue to the firm, its profitability and efficiency.

2.3.2 Business Oriented Studies

While studies found in planning and geography oriented journals tend to approach the problem of firm location from an outsider's point of view, academic papers with an operations research bent approach the problem of facility location within the context of the individual firm. These considerations are important to better understand which considerations are primary to a firm's location decision, as opposed to only those location factors that may have public sector impacts.

Typically, facility location falls within the strategic level of decision making and can be classified as a "strategic level network design problem." (Korpela, Lehmusvaara, & Nisonen, 2007 p.135). Planning levels within Supply Chain Management (SCM) are typically referred to in terms of their time horizon, with the strategic level being the longest term time horizon and include the siting of facilities. SCM is inextricably linked with facility locations because "the strategic level deals with decisions that have a long-lasting effect on the firm. These include decisions regarding the number, location and capacities of warehouses and manufacturing plants, or the flow of material through the logistics network" (Melo et al., 2009 p402). Lower levels of decision making include tactical level decisions such as the selection of transportation modes and inventory policies which are made on a quarterly to yearly basis. Operational level decisions involve vehicle routing and scheduling, and are made on a daily or weekly basis (Chopra & Meindl, 2004).

Melo et al., (2009) also note that while location decisions are undoubtedly a strategic level decision, a number of decisions that are made in shorter time frames, at the tactical or operational level, will affect the final facility location. These could be inventory control policies,

choice of transportation modes and capacities, warehouse layout and management, and vehicle routing. For this reason, operations research models try to incorporate as much uncertainty into facility location models to approach an optimal *firm-level* solution for the facility location problem.

Traditionally, the facility location problem has been approached through the use of techniques such as the p-median problem that minimizes the weighted distance between facilities and customers. Difficulties in solving this problem, and various strategies that have been developed such as dynamic and stochastic programming, and scenario planning techniques are discussed in Owen and Daskin (1998).

A review of models that incorporated multiple objectives in the siting of facilities was undertaken by Current, Min, and Schilling (1990). In this article, 45 papers were reviewed to explore differences in how facility locations can be optimized. They summarize objectives of the different models, as shown in Figure 2-3.

Variables in Multi-Objective facility location models	
Cost objectives • Minimize the sum of distances from demand to facilities • Minimize the sum of distances from facility to nearest competitor • Minimize the maximum distance between demand and its nearest facility • Minimize the maximum distance between facilities • Minimize distance from each demand node to its nearest facility • Minimize the number of facilities • Minimize the total facility costs • Minimize cost in excess of budget • Minimize total operating costs • Minimize total transportation costs • Minimize total costs (fixed and operating) • Minimize total user costs • Other	*Demand-oriented objectives* • Maximize demand assigned to a facility • Maximize estimated demand satisfied • Maximize distance to competition/other facilities • Maximize total demand covered *Profit objectives* • Maximize return on investment • Maximize output • Maximize market share • General *Environmental objectives* • Minimize degradation of air quality • Minimize reservoir construction • Minimize population at risk • Maximize amenities *Others* • Other objectives including general functions

Figure 2-3: Facility objectives included in Current et al., 1990

Also, measurements of the efficiency of facility locations have been undertaken by Bhatnagar and Sohal (2005) through the creation of an index of supply chain performance. This analysis showed that firms that take a more comprehensive set of location factors into account

when siting their facilities tend to have more competitive supply chains, and thus a more competitive firm. The variables included in the index are reproduced in Figure 2-4.

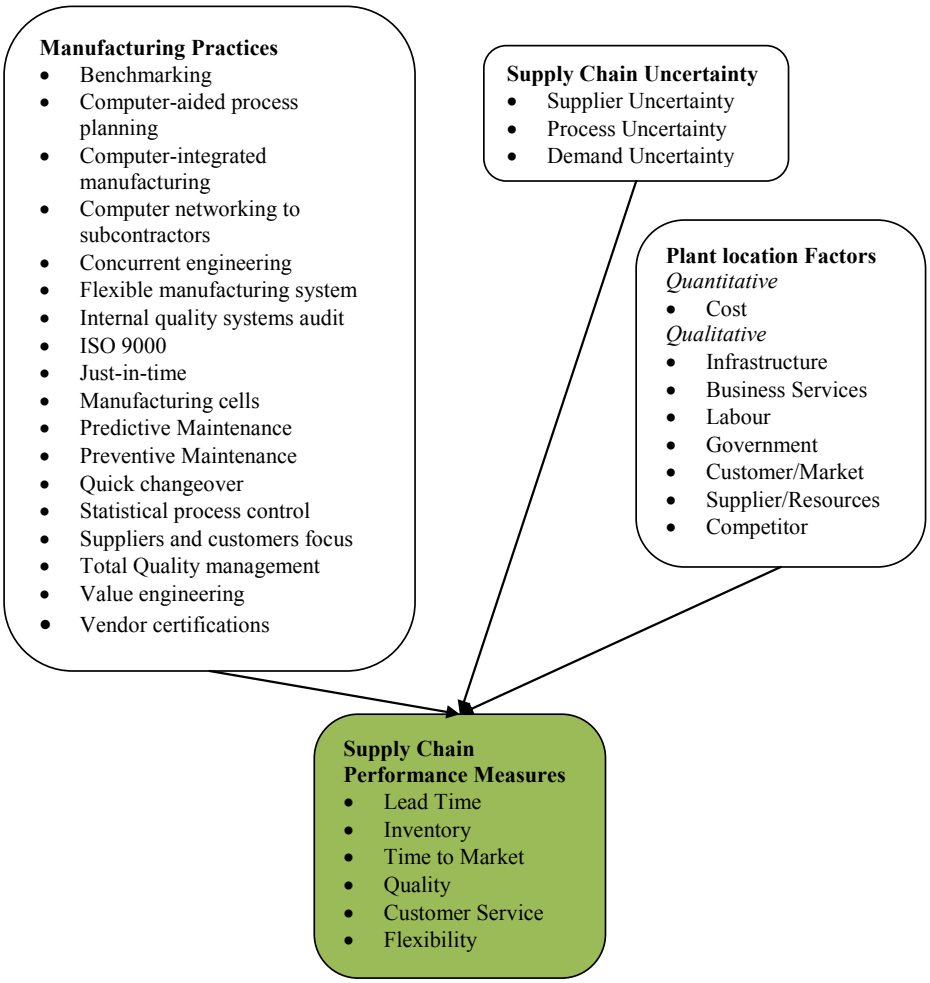


Figure 2-4: Inputs into Supply Chain Competitiveness Index (Bhatnagar & Sohal, 2005)

Measurement of the performance of a firm in this manner shows the complexity of location decisions. It clarifies that firms do take into account qualitative factors in facility location decisions. Examples of modeling exercises that attempt to incorporate qualitative variables include Hugo and Pistikopoulos (2005), who developed a model that includes environmental and 'Life Cycle Analysis' considerations into the supply chain design process. Chan et al. (2007) developed a framework within which the Analytic Hierarchy Process (AHP), applied to facility location problems can be improved, exemplifying attempts to improve decision making processes by including qualitative variables into the decision making process.

Table 2-2: Categories of Location Factors

Author	Summary	Location Factors of Importance for Industrial Firms
Melo et al. (2009)	Summarized papers that have developed different location-allocation models for supply chain applications.	• Note that firms try to incorporate as many variables as possible into the location choice decision. • Discuss further research opportunities, including more integration of operational/tactical decisions into the facility location problem, and a need for more research into reverse logistics.
Targa et al. (2006)	Studied the propensity of firms in Maryland to relocate.	• Validates that accessibility to high-quality roadways are very important in determining a firm's propensity to relocate.
Bhatnagar and Sohal (2005)	Through a survey of firms in south east Asia, established a link between operational competitiveness and location choices of facilities.	• Finds a relationship between qualitative plant location factors and operational competitiveness. • Does this through an index of supply chain competitiveness.
Kawamura (2001)	Examined business locations over time in Chicago.	• Suburban businesses moved closer to freeway ramps. • Businesses in urban core moved towards transit access.
Leitham, McQuaid, and Nelson (2000)	A stated pairwise comparison of location preferences of UK firms.	• Found that importance of transportation infrastructure varied by the origin of firm. UK companies valued roadways the highest, while foreign companies emphasized workforce and the premises.
Button et al. (1995)	Surveyed all commercial and industrial properties within a region in Scotland to determine how transportation infrastructure affects their location choice.	• Transportation infrastructure is seen differently depending on the: origin of firm, size of firm, location of parent company, and attitude to transport links by mode. • Also, poor infrastructure won't cause a firm to move, but is included in their search for a new site.
Barkley and McNamara (1994)	Surveyed new branch start- ups in the US southwest, both large and small firms.	• Results indicated that smaller firms do less extensive site searches than larger firms. • Differences between selections of community versus county level location factors but only for larger firms; smaller firms were inconsistent.
Current et al. (1990)	Summarized papers that all have multi-criteria objectives included in models of facility locations.	• Found that, in decreasing order, variables used in locating facilities are: o *Cost objectives* o *Demand-oriented objectives* o *Profit objectives* o *Environmental objectives* o *Others*

2.4 Logistics Firms' Location Choices

Trends in logistics operations and technologies have a direct impact on the location choices of logistics firms. Changes currently affecting logistics operations have been identified by Bowen (2008) as: the globalization of production networks, streamlining the supply chain to compete with other firms based on time, and consumer demand for customization of products.

These changes have likely affected the factors that influence the location choices of logistics firms. As a dynamic process that is constantly in flux, Hesse (2008) notes that the "outward spread of factories and manufacturing districts has been a decisive factor of North American urbanization since the mid-19th century." Freight sprawl cannot be seen as a new phenomenon; rather the factors that influence the outward spread of logistics firms have changed over time and are influenced by logistics operations, the management of these operations, the physical characteristics of logistics facilities, and the operating environment of logistics firms. In addition, Hesse (2008) notes that distribution centres are to be placed as close to customers as possible, but as remote to areas of high land rents as necessary. This observation is consistent with earlier discussions of the role of transportation costs in terms of firms orienting themselves between their suppliers and markets.

The emerging dominance of 3PLs has changed the management of supply chains. Agreements between shippers, receivers and 3PLs are contractual in nature leading to many location choices being relatively temporary. While in the past, business planning horizons were as far ahead as 10 years, today firms plan for 3-5 years in advance. The shortening of planning horizons has lead to the increased prevalence of renting and leasing of facilities (Hesse & Rodrigue, 2004; Supply Chain Brain, 2010). The extent to which Canadian logistics firms are apt to have short planning horizons will be explored in this study.

While planning horizons have been shrinking, paradoxically, the demand for built-to-suit space has been increasing. The physical structure of the modern distribution centre is demanding more horizontal as opposed to vertical space to facilitate a high throughput of goods, and less inventory (Hesse, 2008). Other physical characteristics of logistics facilities are a demand for large, mainly greenfield lots, space to expand operations, and the necessity for a "robust" operating environment that supports 24/7 operations.

Some observers have noted that there are differing rates of obsolesce of logistics real estate in different areas of the world. Within Western Europe and Japan, about 2-4% of buildings become obsolete each year, while in the US the rate is between 1-2% (Supply Chain Brain, 2010). Assuming that the US rate is comparable to the Canadian one, then this would suggest that there is an opportunity for planners to capitalize on this rate of change within the industry, to provide suitable sites with a robust operational environment, and to reduce the opportunity for conflict with other uses.

The concept of 'logistical friction' has been introduced by Hesse and Rodrigue (2004) noting that spatial transaction costs are not merely composed of transportation costs, but also include the organization of the supply chain and transactional and physical environments that movements take place within. McCann and Sheppard (2003) also purport that more variables should be included when considering spatial transaction costs and, through the review of a supply chain management textbook, we can note that a firm's distribution network, i.e., the number of facilities within its scope of operations is determined by the sum of inventory, transportation and facility costs (Chopra & Meindl, 2004). As the number of facilities increase, total logistics costs will decrease, and then eventually start to rise again. Initially, the total logistics costs decrease because of savings in shorter outbound transportation, which is typically more expensive then inbound transportation. As more facilities are built, then the transportation savings are overtaken by further spending on inventory and facility costs. Depiction of these costs can be seen in Figure 4-24: Total Logistics Costs.

2.4.1 Accessibility to Infrastructure

Accessibility to infrastructure is important for generic firms and even more so for logistics firms that generate large amounts of inbound and outbound freight traffic daily. Bowen (2008) has observed that there have been recent changes in the types of transportation infrastructure that are demanded by logistics firms, that road and air accessibility is overtaking rail access, and especially seaport access in importance. Commentary from industry experts confirm that highway access is indeed critical as Rob Cameron, Vice President of Urbacon, a Canadian construction company, stated that – "understanding the highway systems is an essential part of the site selection process" (MacDonald, 2008, p.30). Additionally, other researchers often emphasize the importance of accessibility and note that the contemporary

supply chain requires flexibility and reliability (Rodrigue et al., 2006; Urban Land Institute, 2004). Traditional estimates of transportation costs do not incorporate these attributes into how transportation infrastructure affects the location choices of firms (Holl, 2004).

The importance of access to highway infrastructure has also proven to be important in Calgary in a recent study. Modelling the performance of transportation infrastructure in relation to the establishment of logistics firms showed that the performance of the highway system has a positive effect on the growth of logistics firms, albeit temporally lagged. (Woudsma, Jenson, Kanaroglou, & Maoh, 2008). That is, logistics firms choose to locate in areas of the network where congestion is lower and therefore performance of the highway system is higher.

Transportation Costs and Firm locations

Congestion is often a subject of interest to the public sector and there exists literature on the price of congestion to logistics firms. McKinnon (1999) has found through in-depth interviews with distribution managers that costs of congestion on logistics firms is hard to quantify, especially at the macro level. This is because the costs of congestion can be internalized easily through providing buffers in delivery schedules, and also because congestion related delays are often smaller than other delays in the system. Within the GTA, aggregate costs of congestion have been estimated to be $2.7 billion in lost economic opportunities for businesses, along with $3.3 billion in costs for commuters in 2006 (HDR Corporation, 2008). While the HDR study incorporates increasing costs of inventory into costs of congestion calculations, McKinnon et al. (2009) posit that congestion effects on the cost of inventory is too complex to price.

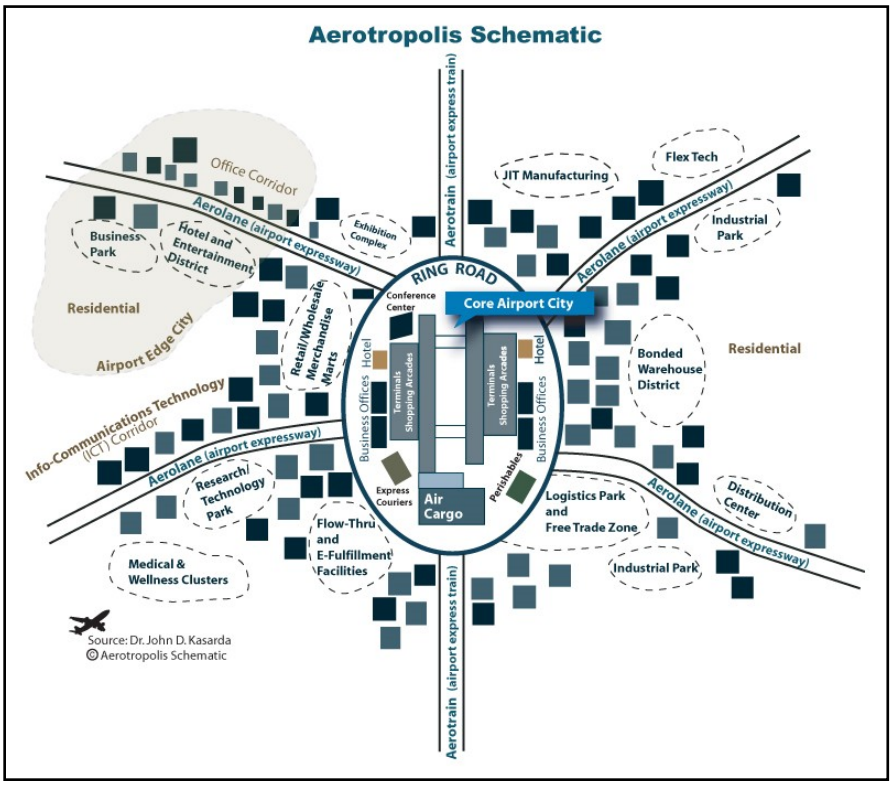
As previously discussed, supply chain network design is affected by transportation, inventory, and facility costs, but is also affected by the response time required by a firm's customers. McKinnon (1998) notes that the physical structured logistics infrastructure and the pattern of trading links between firms will determine the number of tonne-kms produced within a supply chain. But the scheduling and management of flows determine the number of vehicle kms. According to these conclusions, we must look towards strategic level decision makers in determining the characteristics of the location choices of firms, while rapid changes that result in less vehicle kms within metropolitan areas can be addressed at the operational or tactical level of the supply chain.

Airports

Empirical evidence supports the assertion that accessibility to airports is important for logistics firms. Observing the patterns of land values around the Schiphol airport in the Netherlands, a major cargo airport, shows that accessibility to this location is highly valued. The Urban Land Institute (2004) reports that office space in the immediate airport area averages 363 euros/m^2, compared to 250 euros/m^2 in Amsterdam city centre. These patterns are indicative of the price that businesses attach to accessibility to major transportation infrastructure.

That airports attract a number of firms has led Kasarda (2001) to propose the concept of airports becoming centres of trade. The speed of delivery essential for logistics today will ensure that logistics firms will cluster around airports. He argues that "the three "A's" (accessibility, accessibility, accessibility) will replace the three "L's" (location, location, location)." Empirical evidence for the growth of airports as hubs of growth for logistics firms is confirmed by Bowen's (2008) article on the importance of airport access to warehousing firms. A conceptual schematic of the typical 'Aerotropolis' from Kasadra (2010) is shown in Figure 2-5.

Figure 2-5: Aerotropolis Concept



Source: (Kasadra, 2010)

Interestingly, evidence suggests that firms clustering around airports do not necessarily utilize the airport for their daily operations. There has been a distinction found at the Schiphol Airport in Amsterdam between 'locked-in logistics' and logistics activity that is not tied to the airport (Warffemius, 2007). In the Canadian context, a 2005 Hemson Consulting report found that only around 10% of the employment clustered around Pearson Airport in Mississauga is directly linked to airport activity.

Containerization and Ports

The effect of containerization of the structure of logistics firms has been dramatic since their widespread adoption beginning in the 1960s (Taggart, 1999). Containerization has been changing the shape of inland transportation because of limited capacities at ports; supply chains have been pushing the activities normally performed in the port city further inland (Notteboom & Rodrigue, 2008). Bowen (2008) claims that because containerization has shifted break-of-bulk locations farther inland and warehousing activity will begin to grow at these locations. These comments are somewhat contrary to the findings of Bonacich and Wilson (2008) who through interviews with managers of 3PLs located in the 'inland empire' of California found that break of bulk locations are found within close proximity to the port of entry. This can happen for two reasons: 1) three international 40 foot containers can be consolidated into two domestic 53' containers, with the international container being speedily returned to the shipping line (Notteboom & Rodrigue, 2008), and 2) because of the unpredictability of overseas shipping. The latter results in import warehouses being built at ports, with the result being that:

> "[Exel's] import warehouse stores goods and does not operate on a JIT basis. Rather, JIT is used by the regional DCs, and this facility serves as a source for them. That is because importing requires time delays. This warehouse, therefore, is not geared to everyday replenishments. Rather, it handles large volumes. (This suggests that flexible production with constant replenishment does not function so much in global production; rather, these import warehouses bring in the goods in bulk and *then* the constant replenishment kicks in.)" (Bonacich & Wilson, 2008 p.142).

Another example of how slow-moving and, more importantly, unreliable sea imports can affect the supply chain and locations of firms can be seen in Dell's printer manufacturing network. While constant high-volume demand is satisfied by a manufacturing plant in Singapore, Dell has also started a manufacturing plant in Vancouver, to satisfy temporary surges in demand that cannot be predicted and planned for (Sheffi, 2005).

This discussion is relevant in the Canadian context because it explains why ports such as Prince Rupert may not grow to compete with Vancouver or Montreal, it simply does not have the warehousing capacity and rapid access to North American markets that is found in Vancouver and Montreal. Also, it begs the question of why previous commentators have cast intermodal inland transportation, and the rise of inland ports, as being the result of a change in the location of break-of-bulk locations. The extent to which inland ports in Canada, such as Winnipeg's CentrePort development will function as break-of-bulk locations should be explored to determine which functions are actually being performed at these locations (CentrePort Canada, 2010).

While the preceding discussion suggests that intermodal service is somewhat dependent on import warehouses located at ports, other discussions in the literature suggest that a Direct-To-Store (DTS) method of delivering goods is gaining interest as well. This method of delivery may prove to be relevant for receiving goods in Western Canada from the Far East, as many firms have their distribution centres which serve all of Canada located in Ontario, so that goods that previously travelled to Ontario from West coast ports, and back again for sale would instead be delivered directly to western customers from the port of entry (Kuzeljevich, 2008).

Recently, the Urban Land Institute (2004) identified three major trends related to the widespread growth of intermodalism. One has been the growth of major new intermodal facilities, and related developments, including logistics firms in select cities throughout North America. The Allen Group development in Dallas-Fort Worth is an example of this (see Figure 2-6).

Figure 2-6: Dallas Logistics Hub

Source: (The Allen Group, 2009)

A second emerging trend concerning intermodalism is the utilization of brownfield sites for new intermodal yards, although this trend is probably more prevalent in the US then Canada. An example of this is the prospective development of a large intermodal facility on brownfield lands in Detriot, MI (Michigan DOT, 2009). Finally, large-scale intermodal facilities in suburban areas are replacing smaller facilities in scattered locations. This can be seen in Toronto with the development of CP Vaughan, replacing the operation of a smaller terminal in the city (Slack, 1999).

2.4.2 Uniqueness of logistics firms

The impacts of macro-level decisions within the supply chain influence the types of facilities that are found in Canadian metropolitan regions. While specific correlations between macro-level supply chain trends and local location choice factors are hard to identify, logistics firms can be said to look for relatively inexpensive land with good access to highways and airports. It is noted that logistics firms tend to locate in areas that are characterized by lower average incomes because of lower land costs, however, not to the same extent as manufacturing locations because of lower employee per square foot ratios (Yap & Rene, 2003).

Logistics decisions may not be all that dissimilar from generic industrial firms, but logistics firms are guided by their intermediary position between sources of goods, and places of

consumption. The rise of 3PLs and the temporary nature of contractual arrangements between shippers and their 3PLs has lead to short-term location choices, as opposed to committing to a life-long location as was common in the past (Hesse, 2004). Furthermore, because of the short-term nature of these contractual agreements real estate industries have positioned themselves to pick generic locations which may be good for many 3PLs, construct facilities on speculation, and do this through specialized branches of their operations which focus on distribution businesses (Hesse, 2004).

From a supply chain point of view, this 'footlooseness' of logistics firms makes sense. Manufacturing facilities typically require large investments, and retail locations are generally selected carefully for their location relative to customers. Both manufacturing and retail locations are less likely to move than warehousing locations, which in relative terms are inexpensive to change and can be more readily adjusted in response to changing strategic goals of organizations (Melo et al., 2009). In general terms, the benefits of a supply chain that is consistent over time is beneficial for the firm, and making good strategic decisions in where to locate any facility, either a manufacturing facility or warehouse, is desirable (Owen & Daskin, 1998).

Metropolitan Areas

The locations of logistics firms and the size of new facilities have been of interest to several researchers. Goodchild (2009) discussed how the construction of mega-DCs within the continental US has changed over recent years. Mega-DCs are defined as those with more than 100 workers and are larger than 500,000 sqft. Consider that the outbound journeys from mega-DCs will be significantly larger than those from more localized DCs which translate into a higher rate of truck ton-kms, and subsequent higher environmental impact. Evidence suggests that these centres are being located in regions that do not have the population base to justify their location, which further confirms the previous observation (Anderoli et al., 2010).

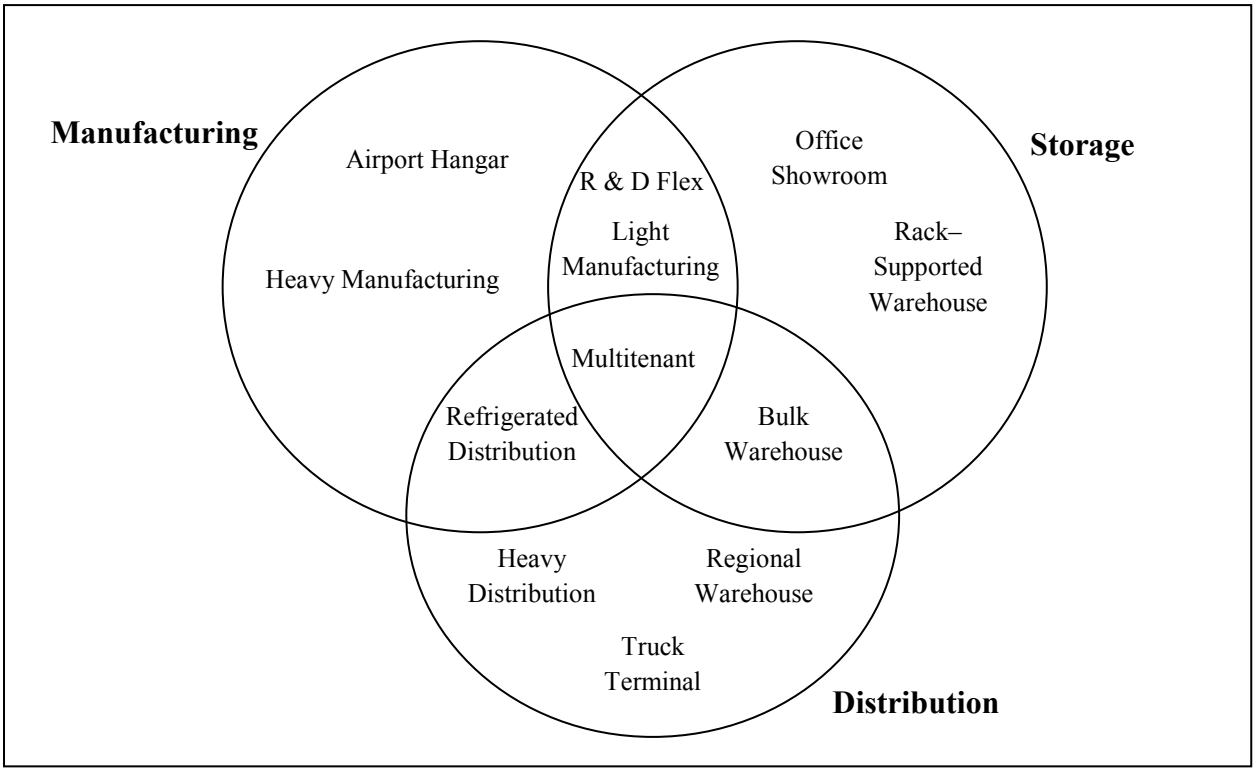
Within the structure of the metropolitan area it has been speculated that logistics activity is moving towards suburban and exurban areas. Cidell (2009) examines warehousing locations at the county level in the US, and finds that decentralization is occurring in many metropolitan areas, but that others have some growth of warehousing firms in central counties as well. Furthermore, evidence suggests that the vast majority of change in the number of warehouses in

a region is determined simply by the growth in population in that region (Cidell, 2009). This would suggest that regional factors drawing logistics firms to a particular location would not be extremely relevant, save for key locations such as Chicago in the US. Determining to what extent these trends are present in Canada has not been examined in any literature.

Types of Facilities

Facilities can be classified according to the attributes of the particular facility, and each particular type of operation will have different locational needs and wants. Yap and Rene (2003) describe the location requirements of heavy distribution versus freight forwarding versus cross docking and other classifications of industrial firms. Each type of industrial building has slightly different site requirements, including differences in the number of dock doors, space for truck staging areas and ratios of office to warehousing space. An example of this can be seen in Figure 2-7.

Figure 2-7: Types of Industrial Properties



Adapted from: Yap and Rene, 2003

Table 2-3: Summary of Location Trends for Logistics Firms

Author	Summary	Significant Trends Identified
Cidell (2009)	Measured the concentration of warehousing and trucking activity in US metropolitan urban areas using Gini indices.	Majority of variation in number of warehouses in a region can be explained by a change in population. Confirmed to some extent: • The movement of freight-related establishments to inland ports • The suburbanization of freight activity
Goodchild (2009)	Discussed changing patterns of warehousing locations in the US, especially the rise of 'mega-DCs'	Attribute growth in DCs in Seattle related to growth in trade through the port of Seattle. Note that the rise in 'mega-DCs' will cause longer outbound truck transportation, as many of these facilities are located in regions whose population does not support them.
Bowen (2008)	Compared the growth of warehouse establishments with how accessible their locations are.	• Globalization of production networks • Streamlining the supply chain to compete with other firms based on time • Consumer demand for customization of products
Hesse (2008)	Notes the growth of logistics firms in suburban locations. Also performed case studies of logistics firms in Berlin and California.	• Location choices are *particularly* made with respect to supply of land, transport access, and other distribution areas/customers • Logistics firms are leading/ pioneering industrial suburbanization • Logistics expansion and use of technologies is more advanced in the US than in Western Europe
Notteboom and Rodrigue (2008)	Discussed the growing use of intermodal containers in inland transportation.	Reliability and capacity issues are critical for maritime intermodal movements, including repositioning empties. Inland terminals will become more significant in the future.
Woudsma et al. (2008)	Drew a relationship between traffic congestion and logistics developments in Calgary.	Finds that there is a temporal lag between logistics developments reacting to traffic congestion.
Hesse and Rodrigue (2004)	Described the evolution of freight transportation systems.	Introduce concept of logistical friction, composed of: • Transportation Costs • Organization of the supply chain • Transactional environments • Physical environments
Yap and Rene (2003)	Catalogued different types of industrial buildings, including various warehouses and truck terminals.	Map logistics firms within some US city-regions over time, discuss differences in locations both temporally and by types of buildings.
Kasarda (2001)	Argued that greater emphasis on speed within supply chains will bring developments clustered around airports.	Hypothesizes that urban land values will be driven by time gradients to access to the airport.
McKinnon (1999)	Examined indirect costs of traffic congestion on logistics activities of 7 distribution centres in the UK.	• Time is a more critical determinant of spatial transaction costs then distance • More facilities may be sited as a strategic response to congestion • Very hard to make macro-level generalizations about how congestion effects logistics firms

2.5 Empirical Investigations of Location Choices

There have been two investigations into the variables that impact the economic rent of industrial warehouse space. Sivitanidou (1996) examined the factors influencing rents on warehouses in Los Angeles. Buttimer Jr, Rutherford, and Witten (1997) examined the relationship between variables such as building characteristics and a change in net employment to warehouse rents in the Dallas/Fort Worth region.

Evidence shows that warehouse rents are impacted by both the physical characteristics of the structure and the location of the warehouse relative to transportation infrastructure and labour markets. Furthermore, Sivitanidou (1996) shows that there are significant differences between the needs of small and large warehouse users. Firms occupying smaller locations are influenced by access to retail markets while larger firms are not influenced by distance to local markets suggesting that their operations are more regional or national in nature. Additionally, distance to freeways, freeway junctions, and airports are significant variables for both large and small warehouses, while distance to ports and rail are not significant in this study.

Location Factors used in Regression Model by Sitvitanidou (1996)
• Net Rent • Size of Facility • Age of Building • Distance to Consumer Markets • Distance to Areas of Manufacturing Employment • Number of Freeway miles in district • Presence of Freeway junction • Distance to Airport • District served by Railway* • Distance to Port* • Distance to large blue-collar worker pools • Per capita income in district * These variables were found to be statistically insignificant

Figure 2-8: Location Factors in Sitvitanidou (1996)

There has been less inquiry into the locational decisions of logistics firms specifically. This may be becoming more relevant if a speculation by Hesse (2008) proves to be true. He hypothesizes that currently logistics firms may be 'pioneering' developments in North America, rather than logistics firms clustering around industrial areas to provide services for shippers and receivers. The latter has been observed to be the trend of logistics location choices in the past. If

this trend of pioneering of logistics firms exists in the GGH, then this will have serious implications for planners in their attempts to constrain urban sprawl.

The extent to which firms are 'locked-in' to a location based on proximity to a major piece of transportation infrastructure, how economics of agglomeration occur for logistics firms, and the location factors drawing firms to a location have been examined by Warffemius (2007) in the context of the Schiphol airport in Amsterdam. Findings of this study suggest that congestion of transportation infrastructure can have an effect on choosing a slower, less congested mode, but not vise versa. The impact that policy makers can have on making a location more or less attractive by increasing or decreasing capacities of various modes will result in changes in the attractiveness of the location to warehouses. The location factors included in Warffemius' study are shown below:

Location Factors used by Warffemius (2007)
• Warehouse location: city where the warehouse is located, • Warehouse classification: own-account; subcontracted; dedicated; public, • Number of main European distribution centres in the warehouse • Value added logistics provided in the warehouse • Warehouse sector • Number of employees • Size of the warehouse • Capital invested in the warehouse building • Capital invested in logistics systems within the warehouse • Region of origin of the "parent company" of the warehouse: Asia; USA; Europe; other regions • Then asked companies to describe typical flows through their facilities: e.g. Origins, destinations?

Figure 2-9: Location Factors used by Warffemius (2007)

In the Central Ontario Goods Movement Study, which approached the logistics industry through a series of interviews with stakeholders, relevant factors for the location choices of logistics firms were identified (iTrans, 2004). These included similar factors as those influencing generic firms, but logistics firms also identified proximity to business services, the owners' home and the cost of their facility as important factors. Furthermore, a key consideration for this study is the observation that when the logistics function is ancillary to the operation of the business, location factors are more complex then when the logistics function is the principal concern of the business. The key consideration identified for logistics firms is the

focus on land and construction costs, which are weighed against the proximity to the principal client. The factors included in this study are outlined in Figure 2-10.

Location Factors included in the Central Ontario Goods Movement Study
• Employment Location factors • Cost of Facility • Labour Pool • Transportation/Logistics Costs • Proximity to Suppliers and Customers • Flexibility for Expansion • Land Availability • Acquisition of Firms • Need for Specialized Buildings • Public Transit Access for Employees • Proximity to Business Services, Restaurants and Ancillary Retail Activities • Official Plan Policies • Owner's Home • Restraints on Trade • Type of Business (Market versus labour oriented firms)

Figure 2-10: Location Choice factors reported in the Central Ontario Goods Movement Study (2004)

Holl (2004) conducted a qualitative survey of firms in the food processing industry in Spain. He analyzed firms that were smaller in size, and found that the location of the owner's home was a critical consideration. Again, access to the primary road network was important. An important consideration for firm relocations was to expand their site and/or operations.

In 2000, the Canadian Urban Institute conducted a study to reach a better understanding of the needs of logistics firms in Mississauga. This study concentrated on large carriers and 3PLs located within the city of Mississauga. The definition of the firms included in this study is outlined below:

> "An industrial facility where warehousing and distribution or other logistics role that supports the supply chain on a contract basis is the principal activity or where warehousing and distribution takes place as a major ancillary function to the core operations of the business. A key characteristic of such facilities is that they rely heavily on trucks and tractor trailers to transport, distribute or transfer goods and merchandise and therefore have multiple truck bays. The primary focus is on large scale facilities (that is, more than 10,000m^2) but does not exclude smaller examples." (Canadian Urban Institute, 2000, p. 2).

Because this study was written for planning staff within the study area, this definition works well to identify logistics firms and will be utilized in this thesis to identify firms of interest in the

GGH. The CUI study surveyed these firms in Mississauga and obtained a yes/no response to whether factors were relevant in their location decisions. These factors are outlined in Figure 2-11.

Location Factors included in Mississauga Warehousing Study
• General Locational Factors • Proximity to Airport • Proximity to 400 highways • Visibility from highways • Proximity to similar firms • Proximity to customers • Proximity to suppliers • Existing building met needs • Site suitable for new construction • Competitive rent/land price • Access to labour • Competitive taxes • Other locational requirements (describe)

Figure 2-11: Location Choice factors reported in the Mississauga Warehousing Study (2000)

Major findings regarding the attractiveness of Mississauga to logistics firms include: a large availability of high quality industrial land, access to major highways and the airport, an appropriate labour market, attractive tax regime, and planning approaches that incorporate the requirements of different types of businesses. These factors will be incorporated into this research to ascertain how applicable they are today, and the relevance of these factors to firms that have moved across the greenbelt.

Table 2-4: Important Location Factors in Empirical Studies

Author	Location	Method	Important Variables
Bowen (2008)	United States – County level	Modeling of number of logistics businesses according to transportation infrastructure	• Proximity to highway and airport infrastructure more important than rail and marine infrastructure
Warffemius (2007)	Schipol Airport area, Netherlands	Interviews with logistics managers	• Economies of Agglomeration • Increasing Air congestion can lead to a modal shift to road, but not visa versa
iTrans Consulting (2004)	Central Ontario	Interviews with stakeholders	• Roadway Capacity • Rail services • Land Costs
Holl (2004)	Spain	Interviews with managers of food processing organizations	• High quality, reliable roads • Access to suppliers less important then customers
Canadian Urban Institute (2000)	Mississauga	Interviews with logistics managers	• Transportation Access • Labour
Buttimer Jr et al. (1997)	Dallas-Fort Worth	Regression modeling of rents versus building characteristics	• Ceiling height (negative) • Age • Number of Ground level doors
Sivitanidou (1996)	Los Angeles	Regression modeling of rents versus building and area characteristics	• Number of Freeway miles in district • Distance to Airport • Size of Facility • Distance to large blue-collar worker pools • Age of Building *For small facilities:* • Distance to Consumer Markets • Distance to Areas of Manufacturing Employment

2.6 Industrial Location Decisions in the Context of Contemporary Planning Paradigms

A prevailing movement among planners today has been to address the problems associated with urban sprawl through 'smart growth' policies to promote healthier, less car-dependent lifestyles. The promotion of communities that focus on the 'new economy' of high-tech and creative industries generally disregard the role of logistics firms. New urbanism has been proposed as a method of increasing densities and bringing people closer to where they work

(Skaburskis, 2006). These design standards may function for employment uses that are able to keep employment densities high, but are not as applicable for employment in sectors such as logistics, which typically have low employee per square foot ratios. The planning focus on mitigating sprawl is seen throughout official plans of communities and the '*Places to Grow*' growth plan and is reflective of the general paradigm of intensification.

Adoption of smart growth principles has been proposed as a solution to address the negative impacts of urban sprawl (see Figure 2-12). Structure of policy directions that are set in place to mitigate sprawl do not generally take into account the operational requirements of logistics firms.

Principles of Smart Growth from the Smart Growth Network (2009)
• Create Range of Housing Opportunities and Choices • Create Walkable Neighbourhoods • Encourage Community and Stakeholder Collaboration • Foster Distinctive, Attractive Communities with a Strong Sense of Place • Make Development Decisions Predictable, Fair and Cost Effective • Mix Land Uses • Preserve Open Space, Farmland, Natural Beauty and Critical Environmental Areas • Provide a Variety of Transportation Choices • Strengthen and Direct Development Towards Existing Communities • Take Advantage of Compact Building Design

Figure 2-12: Principles of Smart Growth

Logistics firms will not easily work within these principles of growth. They are not easily mixed with non-industrial uses, and generally do not work well within existing communities because of the large amount of truck traffic they generate. In the planning literature, research on the industrial locations often focuses on the possibility of creating 'eco industrial' parks and facilitating industrial symbiosis (Razin, 1998). Razin (1998) does address industrial land uses and discusses how planners can approach controlling the spread of industrial sprawl through land use controls and tax sharing between abutting jurisdictions to promote fewer non-residential developments in more centralized areas.

Density controls that have been put in place by the Government of Ontario within its new planning regime have the effect of putting further pressure on logistics firms to re-locate outside of the built environment. The *Places to Grow* growth plan states that development within the

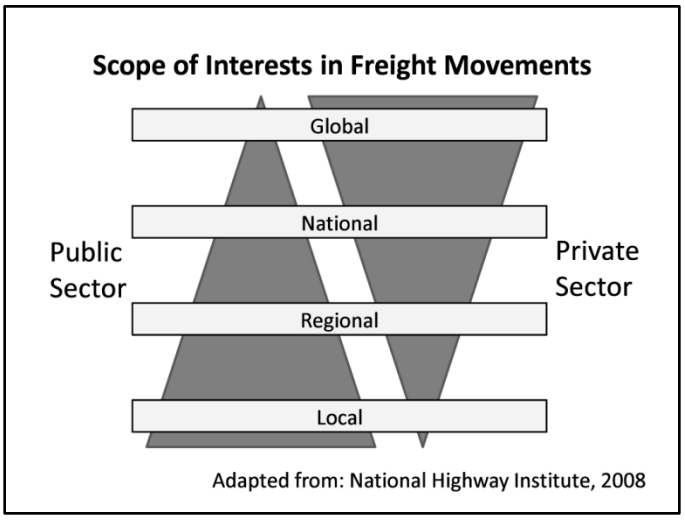
GGH must be intensified. The effect of this policy on the location choices of logistics firms will be determined over coming years, and this study will investigate how factors that are pressuring an increase in land prices will affect the movement of logistics firms.

For planners to realistically address issues relating to freight sprawl, they must first understand the factors causing it to happen. To address local location decisions that will be investigated in this study, they must be examined through the lens of a regional strategy, or attempts to mitigate impacts of logistics firms will simply cause an exodus to the nearest municipality that has less stringent standards typically being located in less urban areas.

2.6.1 Scope of Interests for Public vs. Private stakeholders

The scope of interests that private sector logistics firms have compared to public sector planners is quite different. While firms involved in the movements of goods have a scope of operations that is generally large and concentrate their operations on a global or national scale, government focus is often concentrated on the local or regional level. This results in planners being less able to mitigate the impacts of freight movements compared to other types of land uses that are incompatible with residential uses. The interrelationship described is seen conceptually below:

Figure 2-13: Scope of Interests in Freight Movements



2.6.2 Planning Initiatives relating to logistics firms

Planners have not been active in planning for freight movement impacts within the Canadian context (Woudsma, 2001; Haider, 2009). However, reviewing international literature there has been more interest shown in incorporating logistics firms and subsequent freight movement impacts. This has been carried out through the promotion of freight villages mostly in the European context (Hesse, 2004), or through planning for intermodal facilities and more fully incorporating them into land use planning in both the US and Europe (Zavattero, Rawling, & Rice, 1998).

Concerning zoning bylaws that relate to logistics firms there is seen to be a mismatch in the operational and site requirements of logistics firms and the consideration of these needs by planners in Ontario. In Mississauga, the Canadian Urban Institute (2000) found that there is little consistency between zoning requirements for logistics firms in the GTA, and furthermore the treatment of trailers parked on site as 'outside storage' is observed not to reflect the realities of a JIT environment where this is often a necessity. Four years later, iTrans Consulting (2004) found the same issues with zoning bylaws and noted that they do not reflect current industry characteristics. This study will investigate whether logistics firms are still being impacted by these planning guidelines today. Freight land use best practices have been suggested by a local transportation planner, but it is unclear whether these have been implemented by any municipalities (Gordon, 2005).

2.7 LCVs and Location Decisions

Literature that is focused on exploring the issues surrounding LCVs focus on safety and environmental issues, but not on interactions that LCVs may have with land use patterns. (Canada Safety Council, 2003; Canadian Trucking Alliance, 2006; CRASH, 1999). Because the literature points to discussions of transportation cost, and its relationship to the location of a firm in relation to both its suppliers and its markets, then LCV use may change the location choices of firms by reducing transportation costs and extending the range of profitability for firms, resulting in different location choices.

The use of LCVs reduces labour costs considerably, because of the use of one driver as opposed to two to carry the same amount of goods. There are also benefits in terms of fuel

savings. A report sponsored by the Canadian Trucking Alliance (2006) has estimated that the creation of the LCV network in Ontario would result in fuel savings of 54 million litres of fuel annually and a reduction of 151 kilo tonnes of greenhouse gases.

Ontario would conceivably benefit the most from LCV use in comparison to other jurisdictions in Canada. The relatively light but space intensive nature of most manufactured goods lends themselves well to use by LCVs (Today's Trucking, 2007). It would be expected therefore that LCVs would be well utilized within Ontario, but land use implications of the use of these vehicle combinations has not been explored. Because LCVs would be in use only on a limited road network, the implications for logistic firms' locations would differ based on their location relative to the LCV network.

2.8 Gaps in Literature

The literature presented in this chapter depicts study of the location choices of firms in terms of actual, optimal, and prescriptive choices. There is a great deal of study that has been conducted on generic industry location choices, but less so for the logistics industry. Through examination of the literature several important gaps have been discovered.

Public sector oriented studies that have been discussed include Targa et al., (2006), Barkley and McNamara, (1994), and Kawamura, (2001). These are investigations of how important transportation and other factors are to a firm's location decision, and concentrate on firms that exist within a specific industry. The logistics industry in particular has been the subject of study with case studies of particular areas (Hesse, 2008), examination of concentration or dispersion (Cidell, 2009), or examining the importance of various types of transportation infrastructure (Bowen, 2008). However, these studies have not examined the importance of various location factors as perceived by logistics firms, especially of those location factors that are not transportation infrastructure related.

Investigations specific to the GGH have been discussed through the literature review, and have included the iTrans (2004) study, as well as the Canadian Urban Institute (2000) study in Mississauga, Ontario. Within these two studies, the location factors of interest to logistics firms were examined through expert interviews. However, no attempts to rate these location factors in terms of their importance or influence have taken place. Additionally, there has been no study of

the differing location choices in the past two years, during which dramatic changes in fuel price have taken place, as well as the largest economic downturn in recent memory.

Concerning spatial transaction costs, there are two perspectives that have been discussed in the literature, especially related to congestion. McKinnon et al. (2009) discuss that the response by logistics managers means that increases in spatial transaction costs due to congestion may not directly translate into increased inventory costs. However, HDR Corporation (2008) discussed how they have developed a method to price cost of inventory as a cost of congestion. Literature is lacking in how logistics managers in the GGH perceive spatial transaction costs.

Finally, for Ontario planners, logistic firm perspectives on the greenbelt and their location choices around the greenbelt are not well documented. The unique characteristics of the logistics industry that have been described suggest that they may be more prone to move over the greenbelt, and the importance of various location factors will be useful in assessing these trends.

3 METHODS

Three methods are employed in this research to address the research questions relating to logistics locations. First, a picture of the size of the sector, its importance to the economy and the existence of 'freight sprawl' will be analyzed across Canada and Canadian metropolitan areas. This section of the study gives an overview of growth rates for logistics firms and general overall trends for the logistics sector. Secondly, primary research involving the use of both a survey instrument and interviews (third method), targeted at logistics professionals is conducted. Within this chapter, a discussion of the methods used will be presented and justified in the context of how similar studies have conducted analysis of this topic. Finally, limitations of the methods are highlighted.

3.1 Review of Methods

Within the studies reviewed in chapter 2, methods used to understand the factors influencing logistics firms' locations were classified into three broad categories. The first includes studies that surveys firms to come to a better understanding of how they rank and view their location choices. Secondly, there are studies that examine trends in locations often derived from government databases, and through spatial analysis that make conclusions about the trends that are occurring. Lastly, there are studies that concentrate on understanding the location choices of firms through interviews with decision makers. All bring a slightly different perspective to the issue, and all these methods have their strengths and weaknesses.

The first category includes investigations at the firm level, but not necessarily incorporating only qualitative data. Leitham, McQuaid, and Nelson's (2000) study used a stated preference model where respondents were asked to choose between hypothetical scenarios in order to decide where they would place their industrial facilities. The form of the survey that is used in this thesis would not be suitable for a binary decision making model, as they point out within the paper they find problems with respondent fatigue.

Button et al.'s (1995) study of firms within the Strathclyde region of Scotland included a questionnaire which had a section that asked firms to rate various location factors as 'very important,' 'important,' 'minor importance,' or 'not important.' These factors were coded on a scale of one to four, and results were analyzed and presented to show the relative importance of

location factors. Then results were disaggregated by characteristics of the firms to explore the relationships between firm characteristics and attitudes towards different transportation modes. Other studies that examine firms' propensity to relocate include Targa et al.'s (2006) study, which built a regression model that took into account changes in transportation infrastructure to explain propensity to relocate. This was also done through an examination of firm-level data.

Amongst the second categorization, studies have used data available on logistics firm locations from sources such as the US census, and concurrent data collection of variables concerning populations, or transportation infrastructure in order to generalize the influences on the location choices of logistics firms. This included Cidell's (2009) examination of warehousing in the US, in which she also examines dispersion of logistics businesses in metropolitan areas using Gini ratios. Bowen (2008) used data to examine locations of logistics businesses in relation to transportation infrastructure. A very significant study done in relation to this thesis was Sivitanidou's (1996) study of warehousing in the Los Angeles area, using economic rents as the dependent variable, and a variety of explanatory variables that were spatially tied.

Thirdly through interviews, location factors are identified that often are not apparent through the previous two methods as they often measure those location factors whose importance for firms has already been established. Nearby the Schiphol airport in Amsterdam, a study was conducted that worked to explain how tied-in logistics firms are to a location (Warffemius, 2007), while in Spain interviews were conducted with managers in the food industry asking about factors influencing their locations (Holl, 2004). Within the area of interest two studies have been conducted recently that identify location factors of interest. These include the warehousing and distribution study conducted in Mississauga (Canadian Urban Institute, 2000), and the Central Ontario goods movement study (iTrans Consulting, 2004).

This thesis will utilize methods from all three categorizations. The initial section of the results chapter will present the results of the data analysis efforts concerning where logistics activity is taking place in Canada. The survey administered is similar to that found in Button et al.'s (1995) study in determining the importance of the location factors for industry in general. The opportunity to measure and rate the importance of location factors for logistics firms has not been found throughout the course of the literature review, especially in Canada. Finally

interviews were conducted with respondents to further validate perspectives on location factors and to elaborate upon the other research questions that this thesis is exploring.

3.2 Analysis of logistics locations in Canada

To obtain a picture of the logistics industry within Canada, data was obtained from Labour Force Survey (Statistics Canada, 2008), the Canadian Business Patterns Survey (Statistics Canada, 2009), and economic data was derived from the Statistics Canada industry accounts division (Statistics Canada, 2010). Data from these sources will be presented to depict large scale trends within the Canadian logistics industry and to set the context for the primary research conducted. Additionally, the structure of the logistics industry within Canadian metropolitan areas will be analyzed, and Gini coefficients calculated which are used to measure the relative dispersion of the logistics industry. Additionally, the numbers of logistics businesses at the census division level of geography are tabulated for all census divisions across Canada, and the number of businesses per capita calculated, as well as growth rates between 1999 and 2008. These years were chosen for comparisons because 1999 was the first year that businesses were classified according to NAICS; previous years were only available through the Standard Industrial Classification (SIC) system.

The classifications that will be utilized within this section have been adopted from Hesse's (2008) identification of logistics firms (see Figure 3-1 below). He notes that logistics firms exist within two different two digit NAICS classifications, NAICS 41 (Wholesale Trade) and NAICS 48 and 49 (Transportation and Warehousing). Furthermore, the NAICS codes that are of interest to this study are spread among a variety of three and four digit NAICS codes making identification of logistics facilities difficult. Furthermore, developments in business practices have made businesses harder to classify. Trucking companies that in the past may have been classified as NAICS 484 – Trucking, today will have included more warehousing and storage operations into their business and often classify themselves as asset-based third party logistics providers, which do not have a separate NAICS code. Some 3PLs will have many different types of operations that could each fall under separate NAICS codes, while others have no assets at all and only provide consulting services although these are often being termed 4 or 5PLs today.

Classification Codes of Interest
Standard Industrial Classification (SIC): • 4200 Trucking and Warehousing • 4730 Freight Transport Arrangement • 4491 Marine Cargo Handling • 50 Wholesale Trade North American Industry Classification System (NAICS): • 484 Trucking • 4885 Freight Transport Arrangement • 492 Couriers and Messengers • 493 Warehousing and Storage • 41 Wholesale Trade

Figure 3-1: NAICS and SIC codes for Logistics firms

Given these issues surrounding classification schemes, data that will be presented from Statistics Canada sources will be aggregated to the two digit NAICS level for most of the analysis. Drilling down to finer classifications resulted in data that was often misleading, especially for analysis done at smaller spatial delineations across the entire country. This data classification issue will be addressed further within the next chapter of this thesis.

3.3 Quantitative Stage

To determine which location factors and planning trends are currently influencing the location choices of logistics firms, a request for participation in an online survey was mentioned Five times in the Supply Chain and Logistics Association of Canada (SCL) newsletter to its members in mid-November of 2009 to early January of 2010. There are approximately 5,000 individuals on this mailing list, but many of them would not be logistics managers of facilities as the membership list of this organization is extensive, including types of businesses other than logistics businesses, and academics as well. One request for participation was also sent out through mention in the Canadian Institute for Traffic and Transportation in December, but no responses were solicited through this method. Also, an email list was compiled from the Canadian International Freight Forwarders Association (CIFFA) website and three direct email requests for participation were sent to 268 individuals. In all, 42 participants completed the section of the online survey that asked for ratings of location factors, while there were 55 individuals who began to complete the survey. Of the 42 participants, 21 were recruited from the Supply Chain and Logistics newsletter and 21 were recruited from the Canadian International Freight Forwarders Association email list.

This survey is not necessarily a representative sample; the total number of solicitations is unknown, and the number of logistics firms in Canada is hard to define. Problems with the identification of logistics businesses were discussed in the previous section, and these problems also apply to defining the population in this sample. The survey was hosted by SurveyMonkey.com, and the survey instrument itself is presented in Appendix A – Methods. In addition to questions on location factors, the survey asks participants to identify the size and type of operation that they are conducting, as well as planning issues that are relevant to their operations, as well as their willingness to incorporate LCVs into their operations.

As this is a volunteer-response survey, the results of the survey are subject to bias because the individuals who choose to complete the survey may not be representative of the larger population of logistics professionals. However, the interviews conducted with participants will help to correct for this bias through a comparison of survey and interview results (Creswell, 2009). Also, the organizations used to solicit responses (SCL and CIFFA) have members from the most recognizable logistics actors in Canada; including SCI Group, Supply Chain Management, and Ryder to give a few examples from the public corporate membership list. Based on their membership lists, the types of organizations that are potentially underrepresented within the results are smaller firms that may not have the capacity to engage in research surveys and those firms who do not have membership in these organizations, again possibly due to a lack of institutional capacity. However, smaller facilities will have smaller impacts on surrounding communities. Additionally, they tend to locate in multi-tenant facilities and exhibit operational characteristics similar to smaller, generic industrial firms (Yap & Rene, 2003).

The presence of freight forwarders within the sample is notable. Hesse (2008) includes freight forwarders into the classification of logistics firms, and Yap and Rene (2003) highlight some differences between freight forwarders and other sub-types of logistics businesses in terms of their building and site requirements. Within the interview portion of the study, only one freight forwarder participated so that while freight forwarders are over-represented within the survey portion of the study, they are under-represented within the interview results.

3.3.1 Analysis of Variables to include

Selection of location factors to include in the study was done through examination of factors that were important within the literature review (chapter 2). The factors that appeared most frequently, and were the most important for all firms were included, such as proximity or access to various transportation infrastructures, as well as access to customers and suppliers.

The list of location factors which firms were asked to rate has been developed through the review of the literature. Additionally, the survey was presented to two individuals from industry, one of whom completed the survey in a pilot study. There were no changes suggested to the structure of the survey following the initial survey completion.

For each location factor, participants were asked 'how important is this factor to your business?', and 'to what extent does your current location satisfy this desire?' In this manner, the desirability of particular location factors can be measured, along with the desire for relocation. The combination of these two questions has not been conducted throughout any of the literature reviewed. The source of the location factors that have been included in the analysis are outlined in Table 3-1.

Table 3-1: Source of Quantitative Variables

Quantitative Variables	Location factor used in:
Land available for expansion	(Canadian Urban Institute, 2000; iTrans Consulting, 2004)
Number of dock doors	(McKinnon, 2009; Yap & Rene, 2003)
Proximity to Highways	All location choice studies reviewed contain this variable
Public Transit Availability	(Canadian Urban Institute, 2000; iTrans Consulting, 2004)
Long Combination Vehicle Accessibility	Not discussed in literature
Access to major customers	All location choice studies reviewed contain this variable
Access to major suppliers	(Holl, 2004; Sivitanidou, 1996)
Airport	(Bowen, 2008; Kasarda, 2010; Warffemius, 2007)
Sea Port	(Bowen, 2008; Hesse, 2008; J. P. Rodrigue et al., 2006; Sivitanidou, 1996)
Rail Intermodal Facility	(Bowen, 2008; Notteboom & Rodrigue, 2008; J. P. Rodrigue et al., 2006)
Ability to operate 24/7	(Canadian Urban Institute, 2000; Hesse, 2008; Hesse & Rodrigue, 2004; iTrans Consulting, 2004)
Trailer Parking	(Canadian Urban Institute, 2000; iTrans Consulting, 2004; McKinnon, 2009)
Truck Staging Areas	(Canadian Urban Institute, 2000; iTrans Consulting, 2004)
Highway Visibility	(Canadian Urban Institute, 2000)
Availability of Skilled Workers	All location choice studies reviewed contain this variable
Availability of Unskilled Workers	All location choice studies reviewed contain this variable
Pro-business regulatory environment	(Barkley & McNamara, 1994; Hesse, 2008)
Low land costs/tax rates	(iTrans Consulting, 2004; Yap & Rene, 2003)
Proximity to other similar businesses	(Hesse, 2008; Warffemius, 2007)

3.4 Qualitative Methodology

The qualitative stage of this study will accomplish two tasks: first, to understand how location choices are made within the context of a national or international supply chain; second, to elaborate on the responses received in the survey to obtain a richer understanding of how logistics firms' location decisions are made within the current planning and regulatory environment.

Major objectives of this stage of research will include:

- Obtain perspectives on current and future trends in the location choices of logistics firms, including;
- Learn about how trade-offs are made between locations within business operations,
- Obtain insights as to whether LCVs will have any impact on a firm's location decisions.

To address these questions, and to build upon the responses from the survey, a request for participation in interviews was included in the survey instrument to recruit participants. Ten participants were recruited and interviewed over the phone. Detailed notes were taken from the phone interviews and were documented immediately following each interview. Statements from participants were then classified according to themes, which correspond to themes found within the results chapter. The purpose of this portion of the study is to help identify issues that have not been included in the data intensive and survey portions of the study. This section will fill gaps within the study and with it triangulation of results will be undertaken to ensure that results are valid.

3.5 Limitations

The data used for the logistics landscape section of this analysis for the most part comes from the Canadian Business Patterns survey (Statistics Canada, 2009). The limitations of the analysis of this data are related to either 1) the limitations inherent in the data itself, or 2) limitations with the methods for analysis of the data. The data is collected as within a survey by Statistics Canada as part of their survey program and sources are validated through Revenue Canada's business number accounts, so that the data itself has a good level of reliability. The major limitation is that the identification of logistics businesses themselves from the data is

highly problematic, as previously discussed, resulting in the use of data aggregated at the NAICS two-digit level. So the inclusion of businesses that do not fit the definition of firms of interest to this study will be included within the results. Although we cannot be sure of the operational types of businesses that are being presented in this work the general patterns of the broader industry that can be classified as logistics is being represented and we should keep in mind this limitation.

The structure of the survey questions that ask specifically about the importance of location factors have some limitations associated with them that have been pointed out within the literature. Some of these limitations as discussed by Blair and Premus (1987) include 1) the possibility of respondents providing answers that they believe will influence policy in their favour, 2) the issue that only existing firms can be surveyed, and 3) that options of location factors chosen by researchers can affect the response of those surveyed. Additionally, Barkley and McNamara (1994) discuss several other limitations such as individuals involved in location decision surveys may list factors as important while they may not have been important at the time of the location choice of the firm. Also, they discuss how individuals who were making the location decision may not be available to complete the survey, in this study, participants are asked to complete the survey only if they are aware of how their location decision was made. Lastly, Barkley and McNamara (1994) note that: "inaccuracies may result from individuals completing the survey in a cognitive dissonant fashion, listing factors believed to be locational attribute but actually not important at the time of the location decision."

These limitations will be addressed through the use of the qualitative section of the study to triangulate results. This will minimize the risk of omission of an important location factor. The participants that were interviewed were all present in their location decision and spoke frankly and clearly about the problems and issues they faced. Not only this, but the respondents that belonged to 3PL organizations talked candidly about how other businesses that they worked for in a consulting capacity made their facility locations. If the interviewees were representative of the survey sample (10 of 42) then the survey results can be seen to be fairly robust and reliable.

4 RESULTS AND DISCUSSION

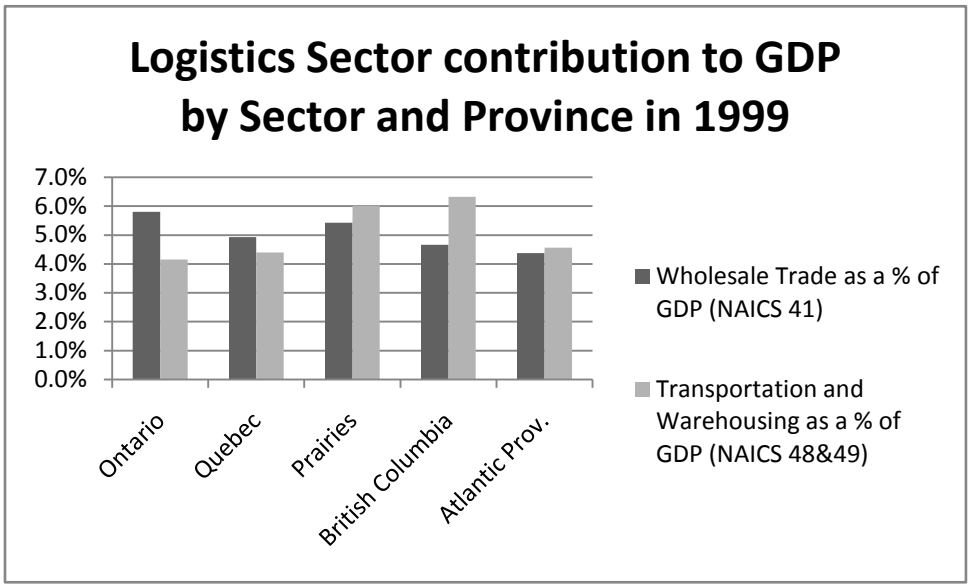
4.1 Logistics Landscape of Canada

Analysis of Statistics Canada data was undertaken to identify locations of logistics activities within Canada and to describe the relative importance of this sector to the Canadian economy. The exploration of macro-level location choices of firms show how logistics establishments organize themselves, and to what extent logistics firms' spatial distribution is changing. Three Statistics Canada data sources were used; data on Canadian economic accounts (Statistics Canada, 2010), the Canadian Labour Force Survey a survey of employees in Canada which identifies the industry of employment (Statistics Canada, 2008), and the Canadian Business Patterns survey, which provides business establishment counts by Census Division (CD), Census Subdivision (CSD), and Census Metropolitan Areas (CMAs) (Statistics Canada, 2009).

4.1.1 Importance of Logistics

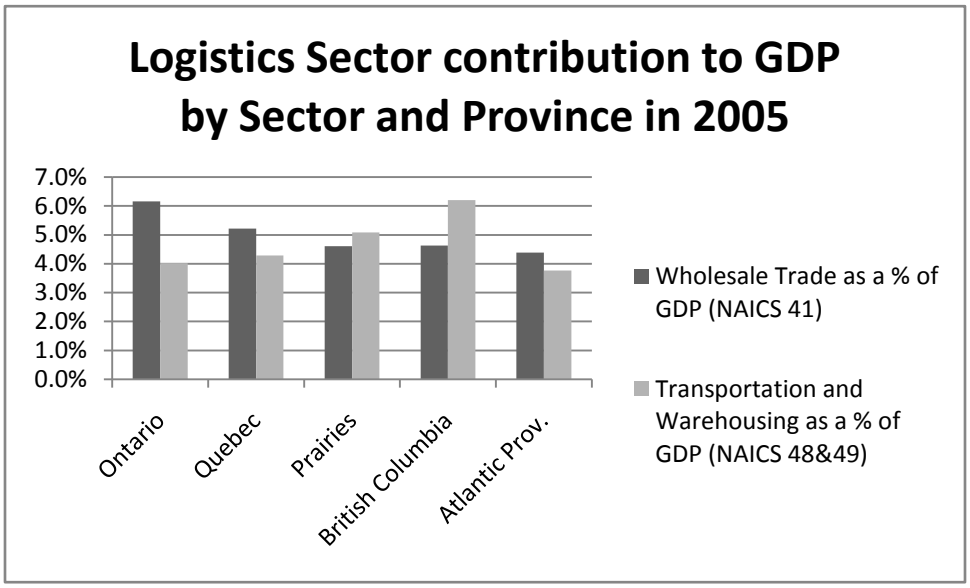
The importance of the logistics industry to the Canadian economy can be interpreted through its contribution to GDP. Figure 4-1 and Figure 4-2 show the logistics percentage share of GDP across various regions in Canada in 1999 and 2005. Comparing the two graphs the only discernable change in the importance of the logistics industry is in the Prairie Provinces, where both Wholesale Trade and Transportation and Warehousing increased their shares of GDP by about 1%. The size of the two industrial classifications combined is impressive; for example in 2005 they contributed just under 10% to the Gross Domestic Product. Differences across the country in terms of the relative strength of Transportation and Warehousing compared to Wholesale trade can be seen, with western regions of Canada having Transportation and Warehousing contribute more to GDP, while eastern regions, especially Ontario, have a higher contribution from Wholesale Trade. This may be the manifestation of an economy focused on resource extraction in the west, while there is higher consumption of goods in the east, driving retail trade.

Figure 4-1: Logistics Sector GDP contribution in 1999



Source: (Statistics Canada, 2010)

Figure 4-2: Logistics Sector GDP contribution in 2005

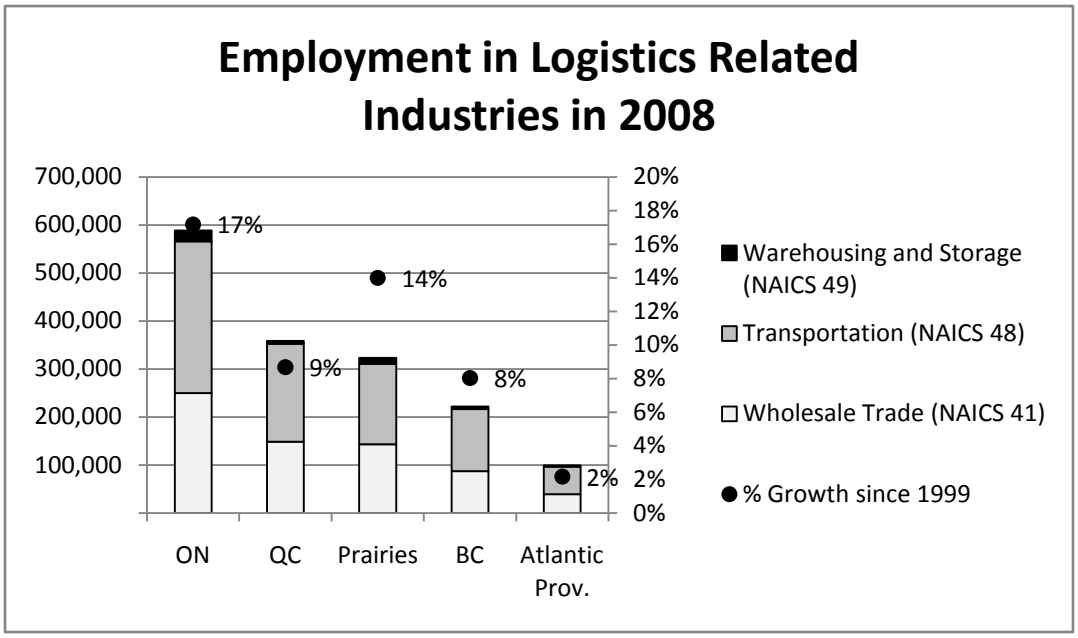


Source: (Statistics Canada, 2010)

According to employment data, Ontario dominates logistics activity in Canada. The number of persons employed in sectors associated with logistics in Ontario is approximately 590,000 or 37% of the Canadian total (see Figure 4-3). Of these employees about half (280,000) are found within the Toronto CMA (Statistics Canada, 2008). Examining the growth rates in employment since 1999, Ontario and the Prairie provinces have had growth rates of 17% and

14% respectively, and were the fastest growing regions in Canada for logistics employment. When data for the Prairies are disaggregated, Alberta becomes the focus of attention, as its employment growth rate is 20%, compared to 3% and 7% for Manitoba and Saskatchewan, respectively.

Figure 4-3: Logistics Employment in 2008



Source: (Statistics Canada, 2008)

This data can be summarized as follows: the contribution of the logistics industry to the Canadian economy is significant, contributing 10% to GDP in 2005. The major areas of growth within Canada are Ontario and Alberta. Not only has employment in these regions increased but the share of provincial GDP in the Prairies as a whole has increased as well, while staying stable in the rest of the country. Now an examination of the spatial distribution of logistics establishments across the country may shed some light upon where, on a more regional basis, logistics firms are locating and where they are growing.

4.1.2 Establishment Data – Census Divisions

Establishment counts were collected for three different spatial delineations within Canada and analyzed in terms of growth and size. Additionally, Gini coefficients were calculated for much of this data. This coefficient (on a scale of 0 to 1) represents a measure of concentration of a phenomenon, with a value of one representing that all logistics businesses are located in one

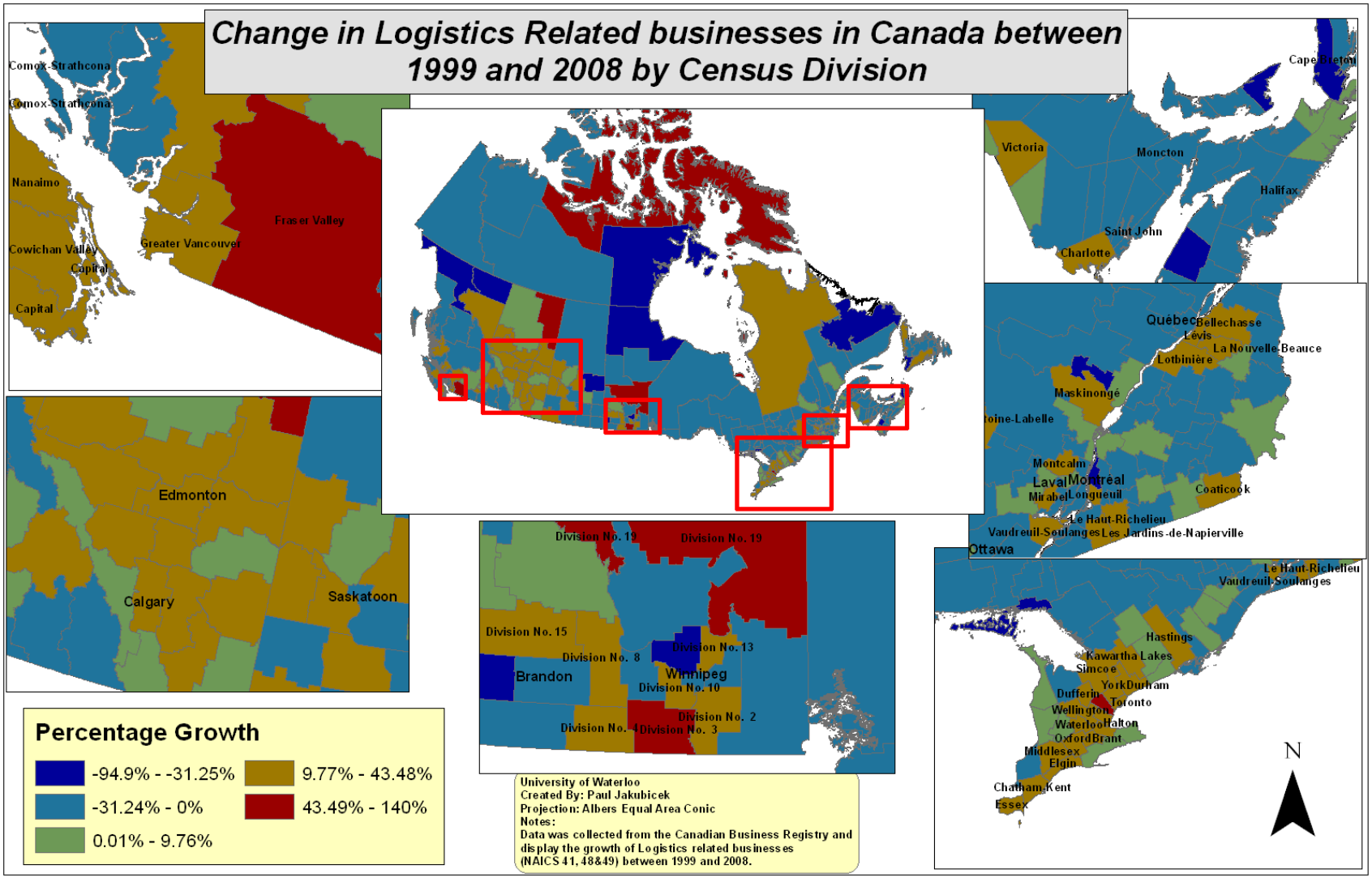
jurisdiction and a value of zero indicating that each jurisdiction has an equal percentage of logistics businesses to total businesses. Observing data concerning Census Divisions within Canada, it is possible to identify where the greatest growth occurred, as well as coming to an understanding of which regions have the greatest number of firms per population. Gini ratios were calculated for Census divisions throughout Canada as well, in three years: 1999, 2004, and 2008. Results of the Gini coefficient calculations are shown in the table below:

Table 4-1: Census Division Gini Index

NAICS 48&49	Gini Ratio	Dissimilarity Index
1999	0.2110	14.95
2004	0.2094	14.87
2008	0.2238	15.98

The results of the Gini coefficient calculations show that while there is some level of concentration of activity at this level of geography, it has remained relatively consistent over time. The dissimilarity index can be interpreted as a percentage of businesses that would have to move in order to result in an even distribution of Transportation and Warehousing businesses. Viewing the map showing growth of logistics businesses across the country (see Figure 4-4), several regions stand out as having higher growth than others within Canada.

Figure 4-4: Rates of Growth in CDs across Canada

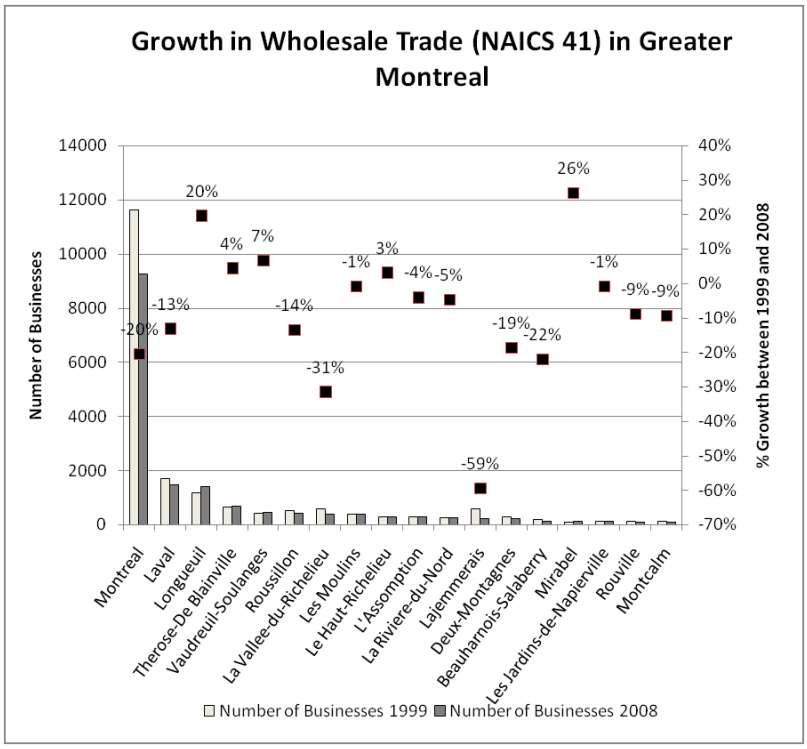


East Coast and Quebec

On the east coast, the Census Divisions that stand out in terms of growth of Transportation and Warehousing businesses over the past decade have been the Victoria and Charlotte Census Divisions within New Brunswick. A consideration of the relative locations of these two CDs quickly reveals the reasons for this growth. Both of these CDs are close to the intersection of the Trans Canada Highway and highway connections to neighbouring Maine, leading to populated areas in the US northeast. The terminus of Interstate 95 is in close proximity to the Victoria CD, while Maine state highway 9 connects Bangor, Maine to the border at the Charlotte CD.

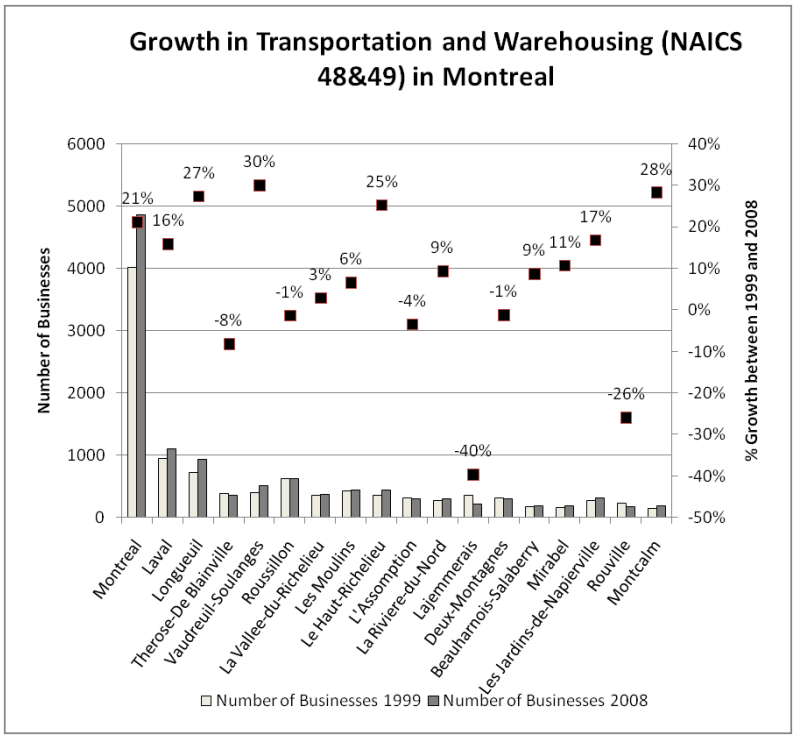
Moving westward, Quebec has experienced growth in some CDs. In the Quebec City area, growth is concentrated along CDs on the south shore of the St. Lawrence, not the north where the central city is located. In the Montreal area, according to growth rates in CDs a trend of suburbanization may be occurring if only concentrating on the growth rates of businesses. However, viewing the absolute number of logistics businesses in the Montreal region, the island of Montreal still has a much larger absolute number of logistics businesses than surrounding CDs. This trend can be seen in Figure 4-5 and Figure 4-6.

Figure 4-5: Number of Establishments in Wholesale Trade in Montreal



Source: (Statistics Canada, 2009)

Figure 4-6: Number of Establishments in Transportation and Warehousing in Montreal



Source: (Statistics Canada, 2009)

Western Provinces

Further west in Manitoba, the CD bordering the US has sustained more growth then the city of Winnipeg (Division # 11) but this area (Division #2 Census Division) has a small absolute number of logistics businesses compared to Winnipeg, 4042 and 615 respectively, in 2008. The CD containing the Winnipeg airport is part of the area designated to become an inland port in 2009, so that growth in the future may move to the north western part of the city (CentrePort Canada, 2010).

The growth of logistics businesses in Alberta and Saskatchewan appears to be highest in regions where oil extraction activities are the highest. The highest growth rate in the number of logistics businesses in this area is the CD containing oil sands development in north eastern Alberta. The growth in this census division is the 4th highest in the country, at 62%. Examining the growth rates in Figure 4-4 the pattern of higher growth is occurring in areas with higher populations, and on major highway routes throughout the province. Calgary and Edmonton have high growth rates for NAICS 48 and 49, at 43% and 32% between 1999 and 2008, and have comparable absolute numbers of businesses, 5,169 and 5,505 respectively. For wholesale trade, Calgary and Edmonton had large absolute numbers of wholesale trade establishments (4,819 and 3,967), but no growth within the time period in question. However, Fort McMurray and Grande Prairie Census Divisions have seen much higher growth than that found in the largest cities in that province. They had growth rates of 88% and 55% in the time period in question for Transportation and Warehousing businesses, with 2008 absolute numbers of 205 and 1,013. So that these two centres, especially Grande Prairie are emerging as being important for the logistics industry, at least on a provincial level. It is notable that these two centres benefit greatly from the oilfield, and Grande Prairie has the additional benefit of being located on the route to the Alaska Highway.

In British Colombia, one CD stands out as a flagship of what may be occurring in the Lower Mainland. The presence of growth in the Fraser Valley CD, containing the CMA of Abbotsford-Mission, is much higher then in neighbouring Vancouver. Growth in the number of logistics establishments between 1998 and 2008 in the Fraser Valley was 50%, compared to Vancouver's CD which grew at 15% over the same time period. This support to various observations of decline in the Vancouver area of the ability of logistics firms to find suitable land

for their operations, and subsequent movement of logistics firms to further east in the lower mainland, or even Calgary (Avison Young, 2005; Donahue, 2007; Kellas, 2006).

Ontario

Before commenting on the results of the Census Division data for Ontario, the size of the industrial market in the Greater Toronto Area should be appreciated. A comparison of industrial land within major North American centres in 2000 shows that the GTA is third, after Chicago and Los Angeles (see Figure 4-7). Logistics firms make up a large portion of the users of industrial land, and their presence in the Toronto area over the past 10 years is still growing. More recent statistics show that this region has the highest number of logistics businesses in Canada by far, with over 51,000, compared to Montreal and Vancouver, the two next largest with 26,000 and 21,000 businesses, respectively (Statistics Canada, 2009).

Figure 4-7: Industrial Land Markets in North America

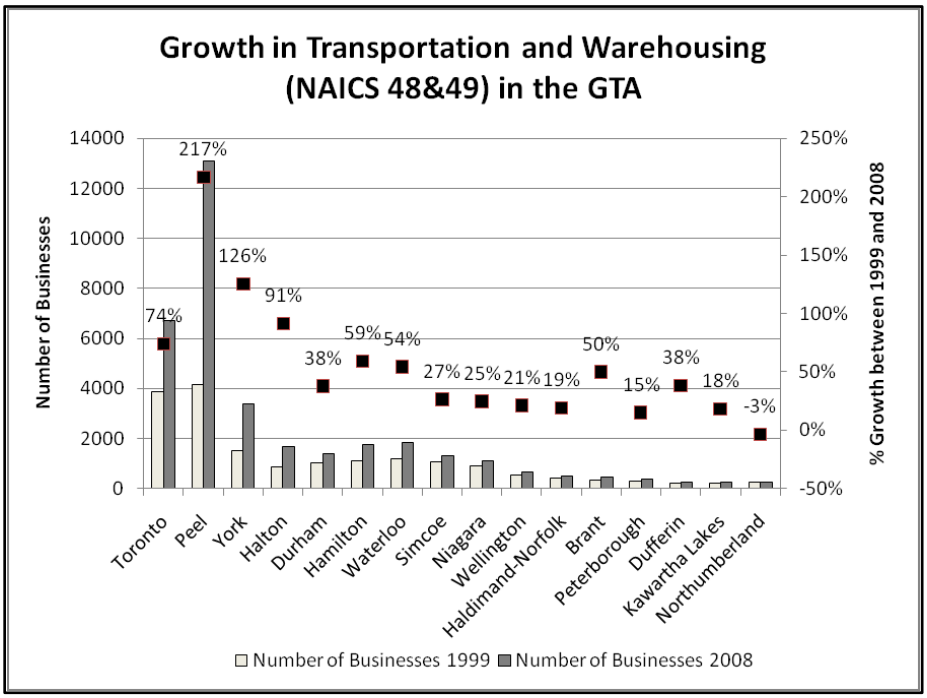
Adapted from: Canadian Urban Institute, 2000

Moving to results of the CD data, in Figure 4-4, we can clearly see that growth in logistics firms is highest in and around the GTA, as well as along the Highway 401 corridor from the Toronto area to Windsor. Additionally, within the Toronto area, the Peel Regional Municipality stands out as the fastest growing area for logistics firms within the 1999 to 2008 time period, with 94% growth in the number of logistics businesses, while York region is second, with a growth rate of 41%.

Disaggregating these categories, we can find that, similar to the Montreal region, growth rates for the Transportation and Warehousing category (NAICS 48 & 49) are generally higher than that of Wholesale trade (NAICS 41) (see Figure 4-8 and Figure 4-9). Concerning Transportation and Warehousing, while Toronto itself has experienced growth in the number of NAICS 48 and 49 businesses, highest rates of growth over this time frame are found in the immediately adjacent CDs such as Peel (217%) and York (126%).

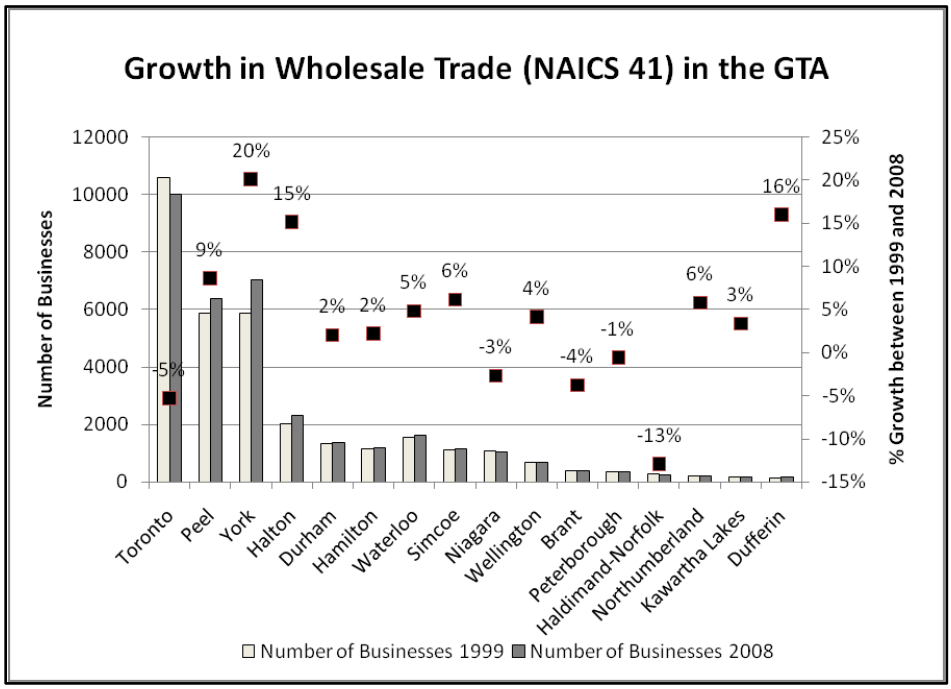
Outer ring census divisions, those outside the GTA but within the GGH experienced less growth in these sectors. The two fastest growing outer ring census divisions were Waterloo (54%) and Brant (50%). Both these areas are on the west side of the GGH, located on transportation corridors that connect the GGH to US markets. The growth of wholesale businesses over the same timeframe is not as large as that of the transportation and warehousing sectors, but exhibits some of the same characteristics. Highest rates of growth are found in municipalities within the GTA, but again Toronto is not experiencing the same level of growth as other GTA municipalities and in this case the number of establishments shrank by 5%. York is leading growth in the number of businesses (20%), followed by Halton (15%) and Peel (9%).

Figure 4-8: Number of Establishments in Transportation and Warehousing in the GTA



Source: (Statistics Canada, 2009)

Figure 4-9: Number of Establishments in Wholesale Trade in the GTA



Source: (Statistics Canada, 2009)

Establishments Relative to Population

Upon examination of Figure 4-10 and Figure 4-11, several observations can be made about the representation of logistics businesses within some Census Divisions in Canada. Firstly, there seem to be CDs in northern areas of Canada that have an over-representation of logistics firms when measured against the population of that CD in the two years examined, 1999 and 2008. For example, in northern Ontario and Quebec, the CDs of Timiskaming (5.9/1000 ppl.) and Temiscamingue (7.0/1000 ppl.) both have higher numbers of Transportation and Warehousing firms compared to the national average of 4.1 in 1999. Also, the numbers of Transport and Warehousing firms are much higher than the national average in areas of northern Alberta and Northeastern British Colombia, such as the Edson CD in Alberta, with a 10.0/1000 ratio of firms in 1999, and 12.1/1000 people in 2008. The Slave Lake, Athabaska and Grande Prairie CDs, all in Northern Alberta have high ratios as well, among the top 12 in the country. Two possible reasons for the high level of Transportation and Warehousing establishments in relation to population could be that either these regions are acting as gateways to areas further north, with goods flowing through terminals and yards in these CDs to serve more remote

populations. Or, these regions contain significant resource extraction activities, which require more transportation services. A combination of these two hypotheses is a possible answer and this could be a subject of further research.

Another trend that becomes apparent when reviewing Figure 4-10 andFigure 4-11 is that there are a few Census Divisions that are adjacent to the US border, and to border crossings that have a large number of logistics businesses relative to the their population. The Les Jardins-de-Napierville Census Division in Quebec borders the US and Interstate 87 connecting Montreal to New York. It has 12.1 Transportation and Warehousing establishments per 1000 people in 2008, the second highest in the country. The Census Divisions bordering or close to the terminus of I-95 in New Brunswick, Carlton and Victoria Counties also are ranked highly, while Division #2 in Manitoba, bordering I-29 in North Dakota also has a high number of Transportation and Warehousing establishments (7.9 in 2008). However, this trend does not continue to Census Divisions in Ontario, which border the busiest US crossings in the country.

Finally, the increase in the proportion of Transportation and Warehousing establishments is interesting to note in two suburban/exurban Census Divisions in particular. In the Fraser Valley CD, outside of Vancouver, the number of establishments per 1000 people increased from 4.0 to 6.1 establishments per 1000 people between 1999 and 2008. The most drastic change in the country however, is in the Peel regional municipality which increased the proportion of establishments to 1000 population from 4.3 to 10.2 in the same time period. This increase reinforces the importance of this region to the logistics industry within Canada.

Figure 4-10: Number of Transportation and Warehousing Firms per capita in 1999

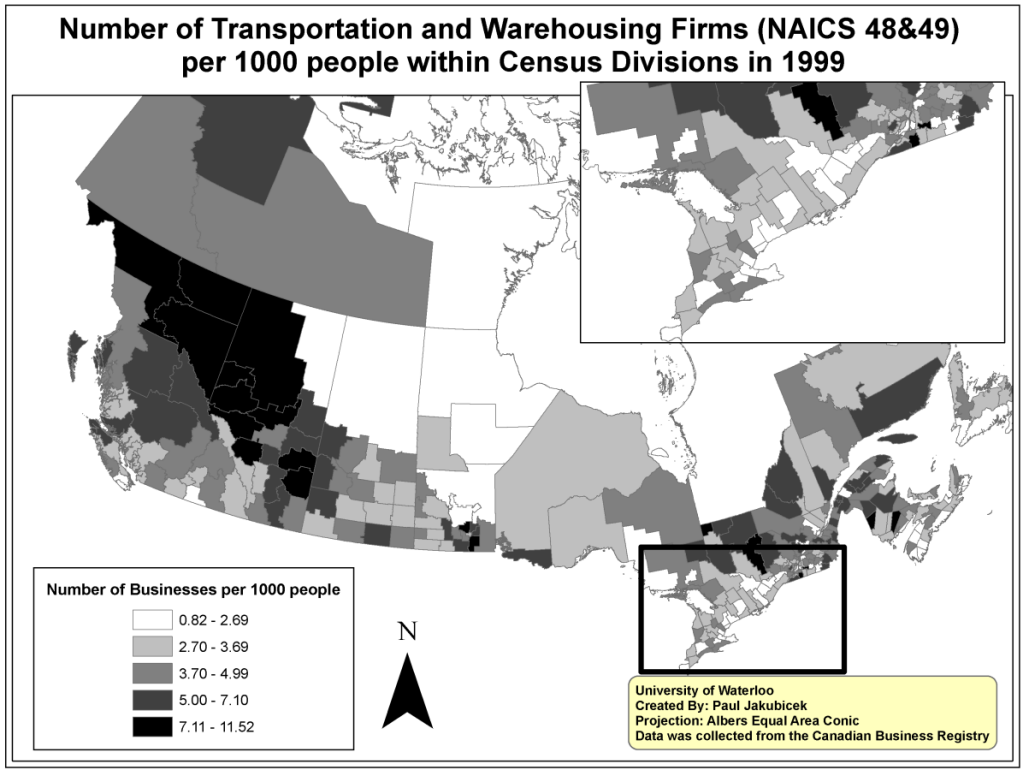
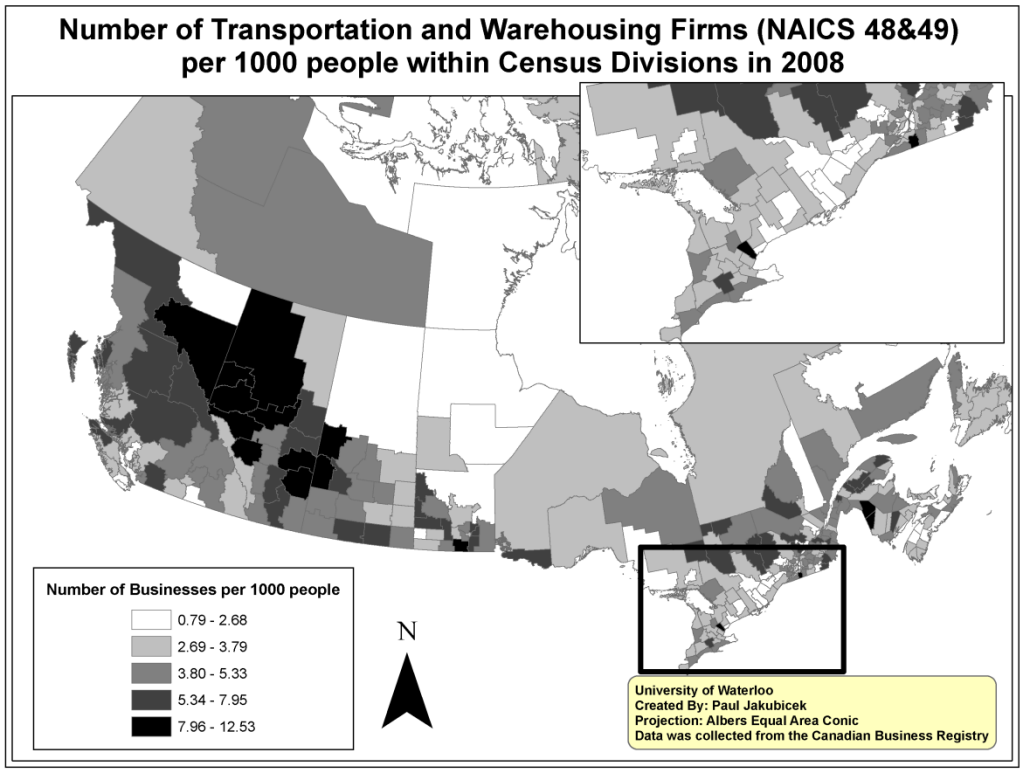


Figure 4-11: Number of Transportation and Warehousing Firms per capita in 2008



4.1.3 Establishment Data – Census Metropolitan Areas

Amongst CMAs within Canada, there is more homogeneity between different CMAs than there are between CDs. This is seen in the Gini Indexes calculated for the distribution of establishments amongst CMAs in the table below. While the Gini index for CDs ranges from .21 to .22, CMAs show a more even distribution, with the index ranging from about .08 to .10 between 1999 and 2008.

Table 4-2: Census Metropolitan Area Gini Index

NAICS 48&49	Gini Ratio	Dissimilarity Index
1999	0.1079	7.52
2004	0.0784	5.20
2008	0.0950	7.21

Furthermore, Figure 4-12 and Figure 4-13 confirm that growth in Transportation and Warehousing has been higher than that of Wholesale trade within Census Metropolitan Areas. Growth has been the highest in the country in the Toronto CMA between 1999 and 2008, at 137% for Transportation and Warehousing, and second highest for Wholesale Trade, at 6%. In terms of the number of firms per 1000 people, the Toronto CMA is the third highest in the country in 2008 after Abbotsford-Mission and Edmonton. The Abbotsford-Mission CMA outside of Vancouver showed extremely high growth as well, with 101% for Transportation and Warehousing and 21% for Wholesale Trade. Most impressive is the growth in importance of Transportation and Warehousing within the Abbotsford-Mission CMA, moving from a 4.09 establishments per 1000 people in 1999 to 7.41 per 1000 in 2008, by far the highest in the country. These values can be viewed in Figure 5-2 in Appendix B – Results. The high rates of Transportation and Warehousing firms per 1000 people in Edmonton begs the question yet again whether Edmonton is acting as a gateway to supplying northern Canada or is acting as a hub for resource extraction activities, or some combination of both.

Figure 4-12: Growth in Wholesale Trade in select CMAs

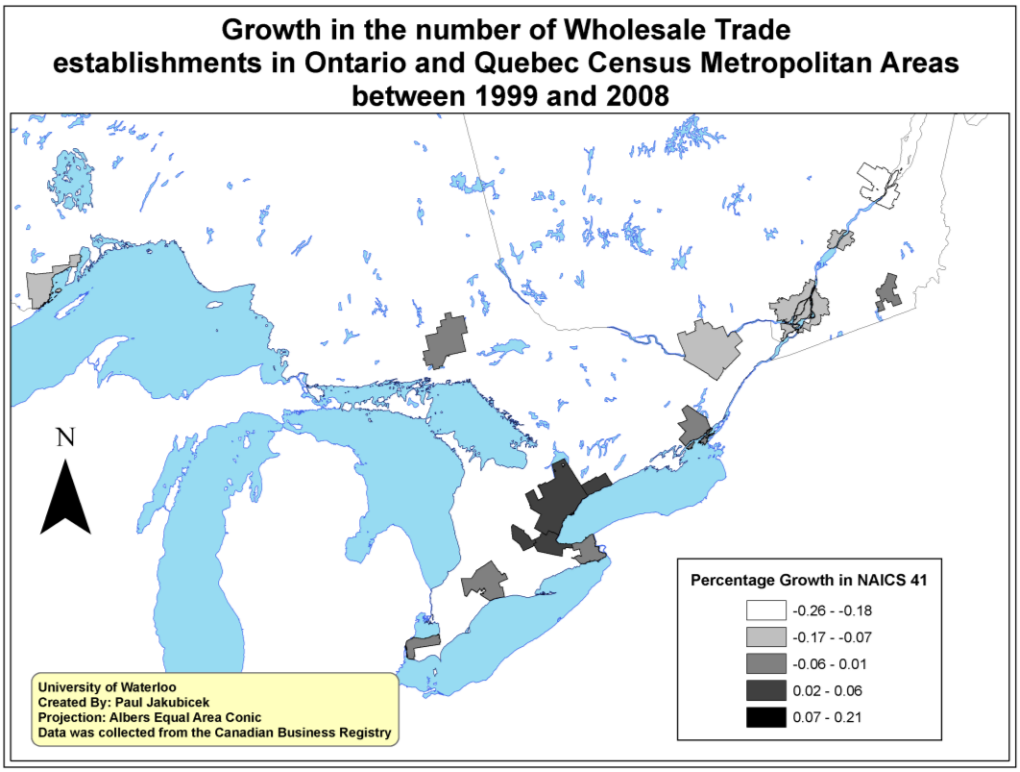
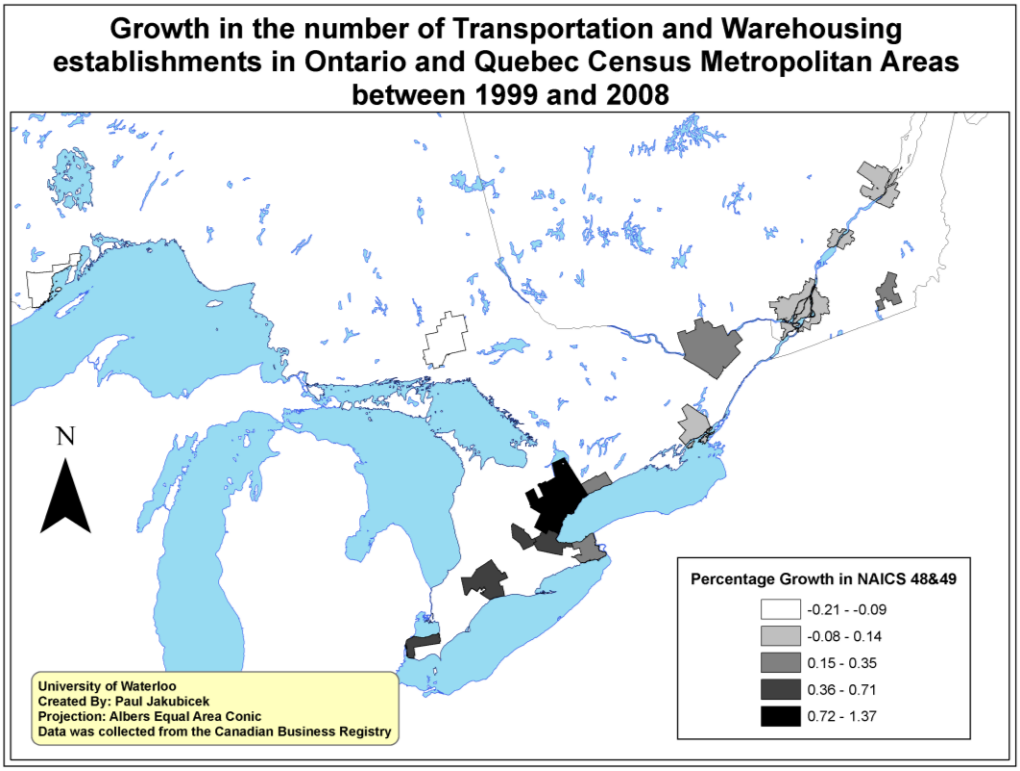


Figure 4-13: Growth in Transportation and Warehousing in select CMAs



4.1.4 Establishment Data – Census Subdivisions

As this research explores issues of siting firms at the intra-regional level, Gini coefficients were calculated for ten Canadian CMAs which have the highest number of Transportation and Warehousing firms within Canada. Gini coefficients were calculated in terms of the number of cumulative totals of all businesses compared to the cumulative totals of Transportation and Warehousing businesses, as performed for the Census Divisions and Census Metropolitan Areas across Canada but this time at the Census Subdivision (CSD) level of geography. A CSD most often corresponds to a municipality, while a Census Division usually corresponds to a regional or upper-tier municipality (in Ontario) or county-level (in the US). From the top ten CMAs Hamilton was excluded from the calculations because of the small number of Census Subdivisions within its borders, while the St. Catharines-Niagara CMA was included in its place because of its location in the Golden Horseshoe of southern Ontario, our area of interest.

As Table 4-3 shows, there are vast differences between different Canadian CMAs and the dispersion of Transportation and Warehousing businesses within those CMAs. For instance, Gini coefficients show that the Calgary and Winnipeg CMAs have logistics businesses spread out very evenly across the municipalities, while on the opposite end of the spectrum, the Toronto and Vancouver CMAs have a concentration of Transportation and Warehousing businesses in particular regions. A comparison of Lorenz Curves of Toronto and Calgary depicts these differences visually; also note the concentration of transportation and warehousing activity in two particular CSDs within the Toronto area, especially in 2008 (see figures 4-14 and 4-15.) These two CSDs, which together account for approximately 50% of the transportation and warehousing firms within the Toronto CMA, are Mississauga and Brampton.

To place this observation in the context of the research question, it is interesting to consider the amount of transportation infrastructure that exists within these two cities. Seven provincial highways serve Pearson International Airport which is the largest air cargo hub in the country. So the concentration of activity in this area could be partially explained by the amount of transportation infrastructure that exists within the two cities of Mississauga and Brampton. Viewing Table 4-3, the Toronto area's Gini index has decreased between 1999 and 2008, meaning that there is a more even distribution of businesses throughout the CMA. However, the

dissimilarity index has increased over the same time period, which indicates that although logistics businesses are becoming more evenly dispersed across the region in general, a disproportionate amount are locating within Mississauga and Brampton causing the dissimilarity index to rise over this time period.

Table 4-3: Gini Indices in top ten CMAs

CMA	Gini Index			Dissimilarity Index		
	1999	2004	2008	1999	2004	2008
Calgary	0.039857	0.040192	0.03906	3.780509	3.517599	2.878052
Edmonton	0.1541	0.128155	0.081362	14.09678	11.20995	6.240248
Kitchener	0.154216	0.153267	0.170157	12.52625	12.7593	15.15985
Montreal	0.27736	0.270458	0.187082	20.40422	19.86151	13.0993
Ottawa	0.234879	0.129414	0.095337	17.46292	11.87843	9.592119
Quebec	0.198739	0.193319	0.074638	14.6555	13.5527	6.09987
Niagara/St.K	0.091817	0.117714	0.124692	7.474158	8.537388	9.330606
Toronto	0.355993	0.294265	0.299498	26.86029	25.38089	32.42082
Vancouver	0.241991	0.271684	0.352444	18.70848	17.70841	27.68412
Winnipeg	0.078332	0.047637	0.051201	7.615386	4.607452	4.653315

Figure 4-14: Lorenz Curves over time in Calgary

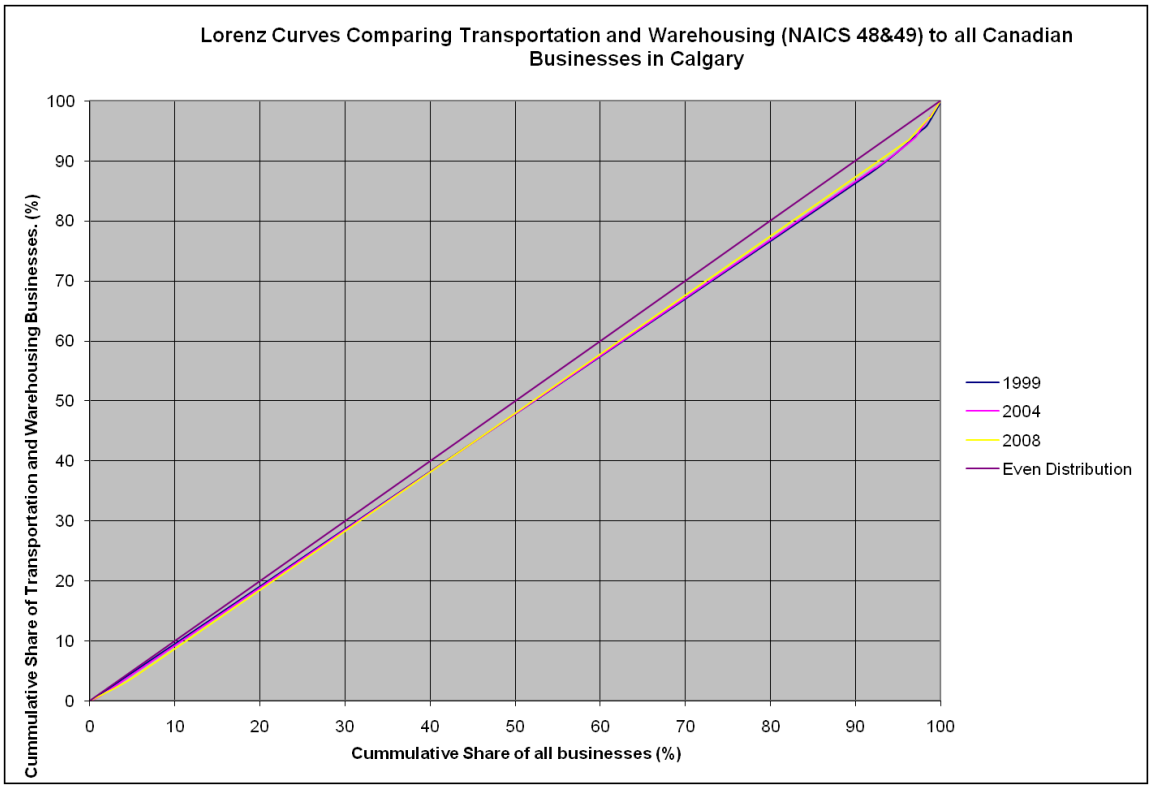
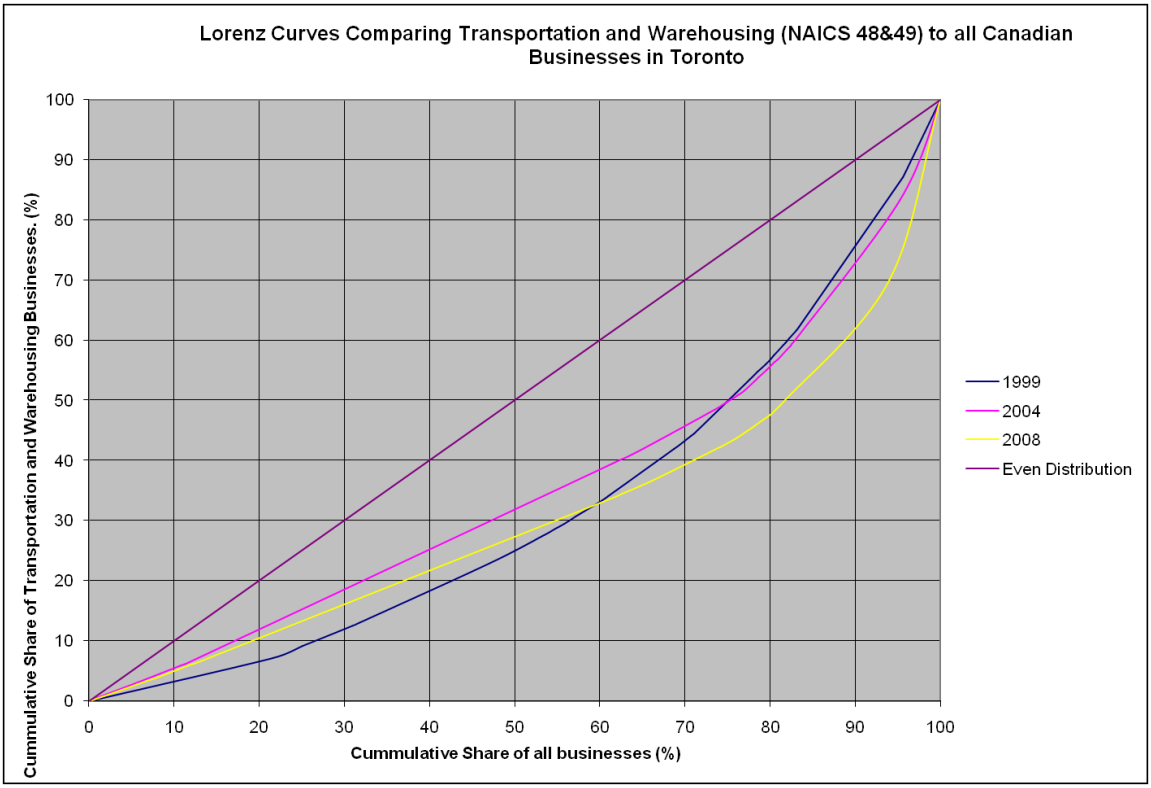


Figure 4-15: Lorenz Curves over time in Toronto



Summary

These results have shown that there are large regional differences in logistics firm locations. In some areas, there is growth in the number of business establishments around gateways to the United States. These areas have small populations and relatively large growth rates, but the absolute number of businesses in these areas is small. Also, these trends are not apparent in Ontario, where the busiest border crossings in Canada are located. Proximity to border crossings may be important in outlying regions, but crossings with large volumes in Ontario do not have the same characteristics, and do not attract logistics developments in the same manner. Possibly, in areas that are less accessible to markets the border itself is enough of a reason to establish a facility while surrounding busier border crossings, major markets are located within relatively close proximity so that crossings in Ontario attract less logistics activities.

In the west, the importance of resource extraction activities has driven the growth in some Census Divisions, especially in the Wood Buffalo district, where oil sands extraction takes place. In British Colombia, growth in the Lower Mainland is dominated, not by Vancouver, but by the Fraser Valley CD, which contains the Abbotsford CMA. In Ontario, and specifically concentrating on southern Ontario, the area of focus is the GTA, with Peel Regional Municipality leading growth, and the influence of the 400-series highway system is apparent in Figure 4-4, leading from Toronto to Windsor. Some evidence of a growth in logistics activity outside of the greenbelt may be taking place but it is really dwarfed by growth within Peel and York Regions.

In terms of the number of establishments per capita, there is evidence of trends that are different from the US experience (Cidell, 2009). First, there seems to be an overrepresentation of businesses in some northern regions, acting as part of a gateway to the far north, or to serve various resource extraction activities. The two regions in urban areas that show the highest increases in firms per capita are the Peel CD adjacent to Toronto, and the Fraser Valley CD, just east of Vancouver in the Lower Mainland. These trends are largely confirmed in the analysis of CMA level data as well. The Fraser Valley, containing the Abbotsford-Mission CMA, is arguably outside of the urban area of Vancouver and is experiencing growth in logistics businesses. In contrast, Peel Region in the GTA usually considered to be within the established

urban boundary, is the location for the most logistics growth. The GTA, and especially Peel Region, with its concentration of transportation infrastructure is able to accommodate growth in logistics businesses while Vancouver is pushing them further east into the Fraser Valley.

Viewing the Gini coefficients calculated for the areas within a CMA, the differences in how logistics activities are spread in different cities becomes apparent. In terms of the Toronto CMA, logistics activities are concentrated within Mississauga and Brampton and there is a greater intensity than is apparent in Calgary and Winnipeg, for example. On this note, it would be interesting to see how growth within Calgary and Winnipeg changes over the next 20 years as intermodal facilities that are planned for those areas grow and are occupied (CentrePort Canada, 2010; CN Rail, 2010). Furthermore, Table 4-3 shows that smaller Canadian centres like Edmonton, Ottawa, and Winnipeg have logistics activities becoming more evenly dispersed within the metropolitan areas. One possible explanation is that logistics activities are being centralized in the largest Canadian centres as firms move towards reducing the number of links in their supply chains, causing a concentration of larger facilities in some regions that can support such facilities like Toronto and Vancouver, while smaller Canadian centres become extensions of these mega regional supply chains.

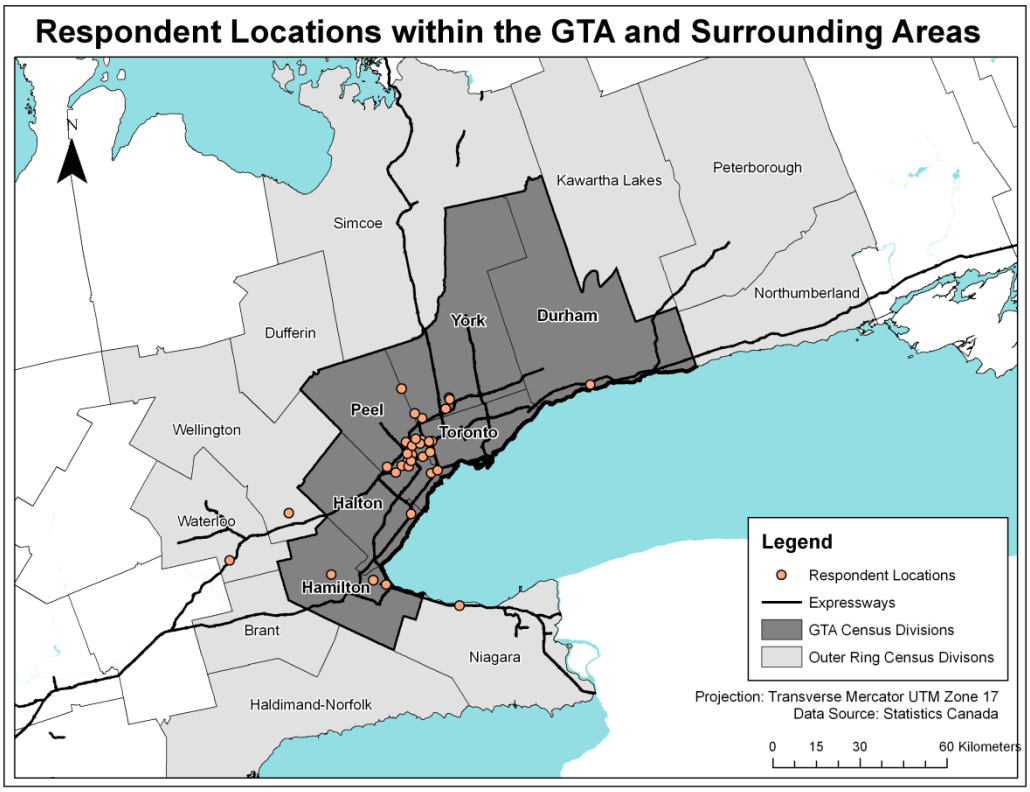
4.2 Survey Results

The survey conducted for this thesis is undertaken to shed light onto the relative importance of location factors for logistics firms within the Canadian context. Here the results of analysis of the survey will be presented, with the sample discussed to add detail to the discussion that began in the previous chapter. Planning related issues and the results of questions concerning LCVs are also discussed.

4.2.1 Sample

The respondents of this survey were located mainly within Ontario (82% of respondents), and within the Greater Golden Horseshoe (76%). A map of the locations of respondents is shown in Figure 4-16.

Figure 4-16: Map of Respondent locations



Respondents are concentrated in Peel Region, which is one of the most important areas for logistics within Canada as evidenced from the previous section. Centred around the Pearson International Airport, the cluster of respondents from this survey are within close proximity to both the airport and the highways that are centred in this area.

The size of facilities that are being operated by participants is shown in Figure 4-17. To come to a better understanding of the differences between large and small facility operators, the importance of location factors will be differentiated by separating the data into two groups, one for those with less than 100,000 sqft operations, and another for those with more than 100,000 sqft. Employment was not used as the number of employees may vary largely within similarly-sized logistics facilities based on the type of operation (Yap & Rene, 2003).

Figure 4-17: Size of Participants' Facilities

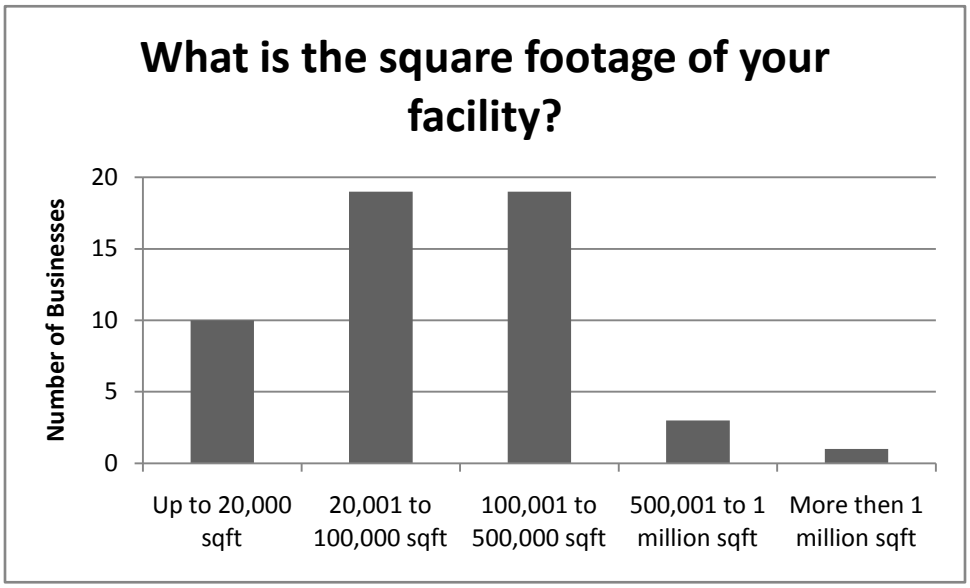


Figure 4-18 shows the self-reported business type; respondents were able to select more then one business type. In terms of the business type operated, it is clear that 3PLs were the largest group of respondents, when both asset and non-asset based 3PLs are combined 37% of the respondents identified their business as one of these two. Difficulties with the NAICS classification discussed in the previous chapter become visible through the results here as many participants do not know how their business is classified (see Figure 4-19). Because the direct emails that were sent to members of the freight forwarding association were more effective in soliciting a response, it is not surprising that freight forwarders (NAICS code 4885-Freight Transport Arrangement) represent the largest reported segment of the sample. Conversely, the wholesale trade industry is underrepresented as these industries make up 47% of the number of establishments in Canada (Statistics Canada, 2009), while only 15% of this sample.

The difficulties of easy classification of the logistics industry are apparent here. Also, the large numbers of 3PLs are consistent with comments that this type of business structure is becoming more prevalent (Bowen, 2008). Keeping these differences in mind, indications of the relative importance of location factors are now discussed.

Figure 4-18: Types of Businesses Operated

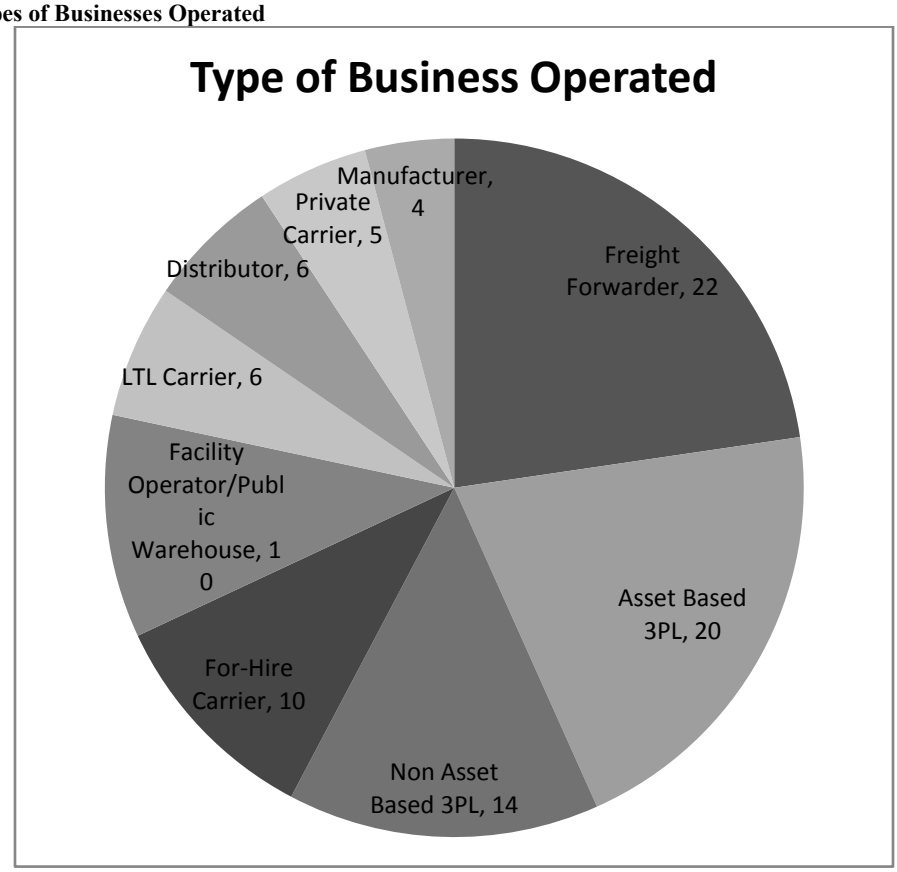
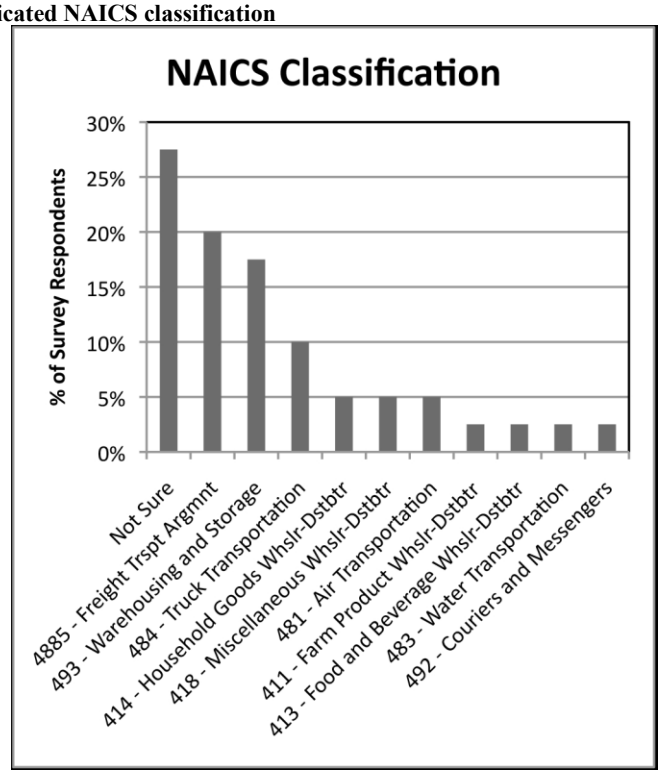


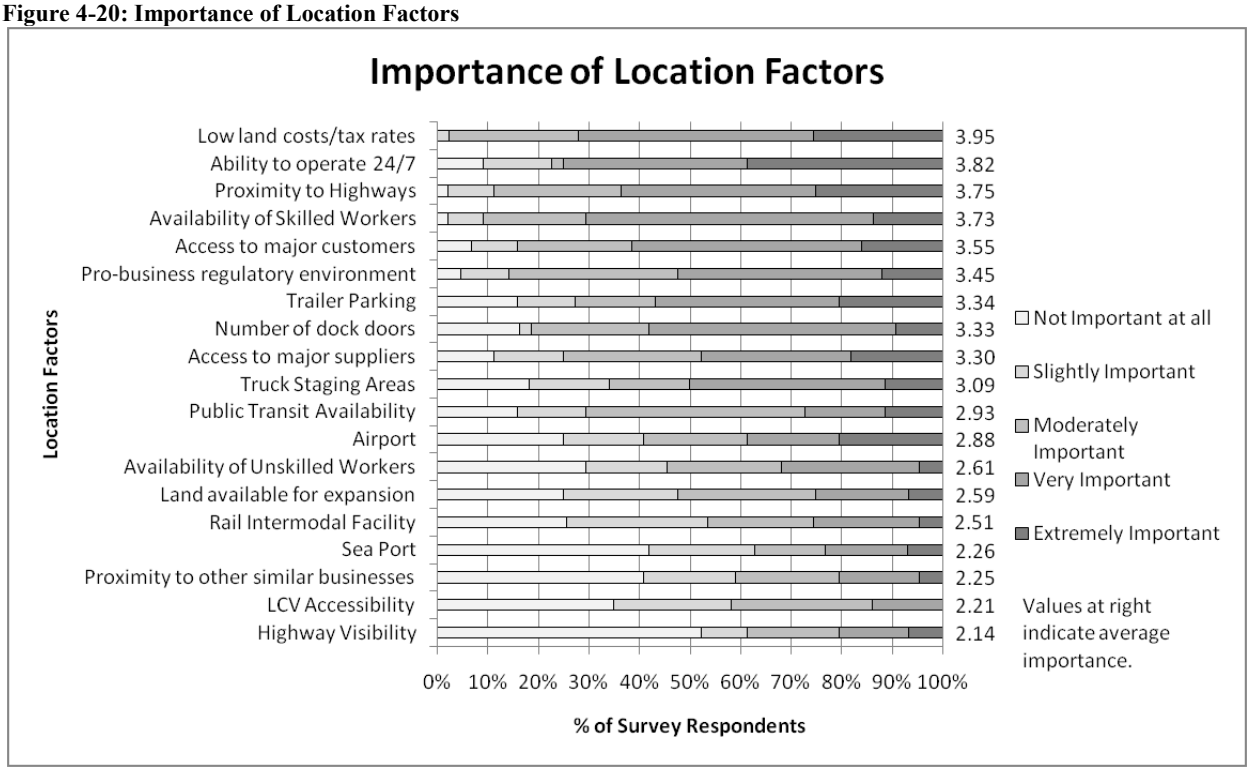
Figure 4-19: Participant indicated NAICS classification



4.2.2 Relative Importance of Factors

Identifying the relative importance of location factors for logistics firms is one of the primary goals of this research. As discussed above, the sample used here does have its limitations, but findings are consistent with much of what has been discussed in the literature. Location factors of interest were identified and for each location factor respondents were asked to rate the factor as 'Not Important at all, Somewhat Important, Moderately Important, Very Important or Extremely Important.' The mean of these responses, on a scale of one to five, is seen on the right side of the graph in Figure 4-20. Although respondents may not have seen the intervals between these categories as equal, nevertheless results show a general rating of how important various location factors are to logistics businesses.

Figure 4-20: Importance of Location Factors



Through examination of important location factors that ranked high in importance we can see similarities between logistics firms and generic industrial firms. For instance, proximity to highways is understandably important for logistics firms as they will move their goods by truck to a large extent (Targa et al., 2006). Proximity to highways is also important for generic industrial firms' location choices (Barkley & McNamara, 1994; Kawamura, 2001). The ability to operate 24/7 is referred to as a location having a 'robust' operational environment (Hesse &

Rodrigue, 2004). This has been stated in the literature often as being an important factor for choosing a site. From these results it could be emphasized that it is in fact extremely important, and that without such an operational environment, a logistics firm will be unable to operate. Additionally, the top ranked location factor was the importance of low land costs/tax rates. This finding is mirrored in other work which argues that distribution and logistics firms are more price sensitive in terms of the rents they are willing to pay compared to other industrial use types (Yap & Rene, 2003).

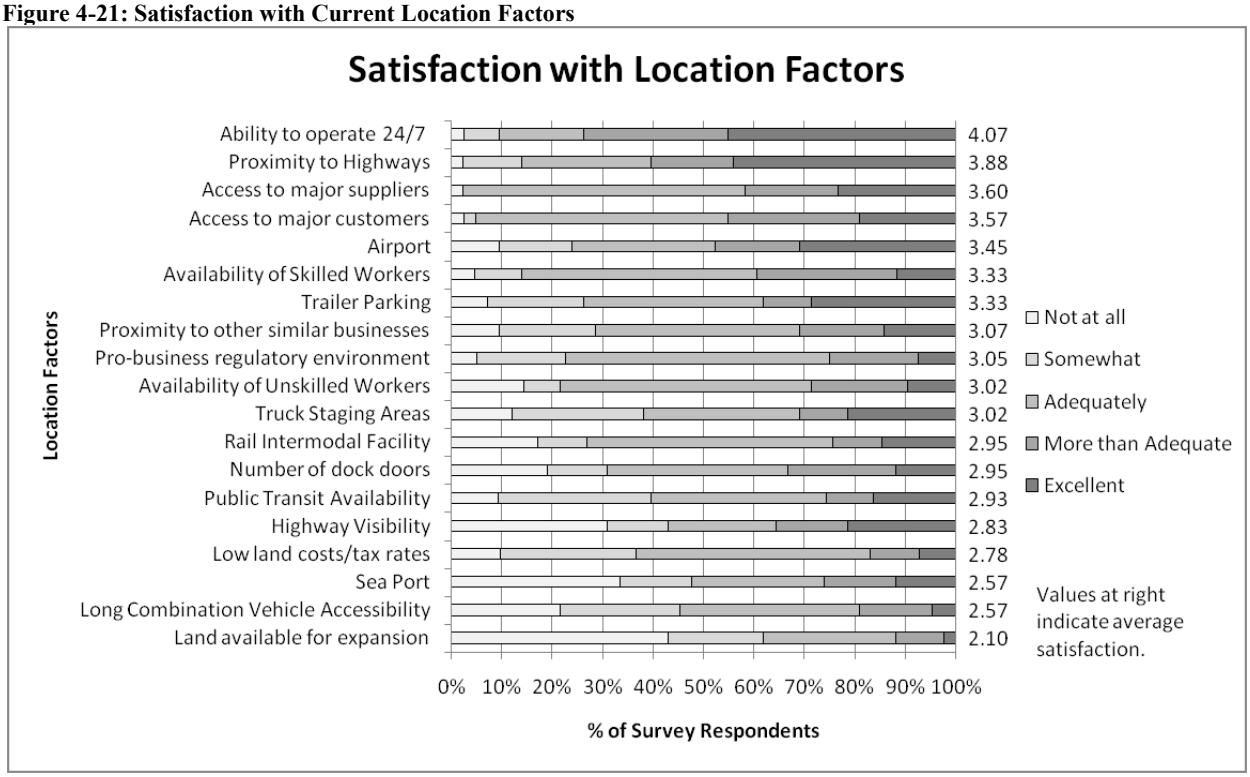
From the findings, it can be seen that the availability of unskilled workers is of less importance to logistics firms. The importance of skilled workers was rated more highly than unskilled workers which is in contrast to the findings of a 1996 study where warehouses were found to move to areas closer to a blue-collar workforce (Sivitanidou, 1996). The trend towards automation in the industry could be leading to a reduction in the number of unskilled workers required by the logistics industry (Bowen, 2008). This would also explain the lack of importance assigned to public transit availability.

Site and building requirements such as trailer parking, truck staging areas, and the number of dock doors are not rated very highly by participants, but they are more important than proximity to rail facilities and the airport. The importance of site characteristics to the type of operation that will be conducted by a logistics firm on a particular site is dependent upon the particular business operation of a logistics firm and will differ based on whether the site houses a truck terminal, regional warehouse or freight forwarder (Yap & Rene, 2003).

While the relative importance of location factors are a key part of determining what logistics firms desire, this question alone does not answer what will influence the reasons for firm relocation. To determine what factors are being accommodated well and those that are not, participants were asked 'the extent to which your current location satisfies [each] factor.' Respondents could choose 'not at all, somewhat, adequately, more then adequate, or excellent.' These responses were scored from one to five and the means are presented in Figure 4-21. Many of the location factors that were seen to be important in the previous discussion were also rated highly by participants in this question. This indicates that participants are satisfied with the location factors that they feel are most important, like the ability to operate 24/7, and proximity

to highways and customers. Having land available for expansion was not very highly rated suggesting that most firms do not have space to expand.

Figure 4-21: Satisfaction with Current Location Factors



4.2.3 Differences between large and small businesses

To fully understand the implications of differences between small (< 100,000 sq.ft.) and large businesses (> 100,000 sq.ft.) in how they value location choices, average rating scores for each group were calculated. A summary of these calculations can be seen in Table 4-4. Furthermore, to better understand the possible differences between these two groups, differences in how large versus small firms ranked location factors are outlined on the right of the table. Positive values indicate that larger firms rated this factor more highly; negative values indicate that smaller firms rated this factor more highly. Highlighted are differences in ratings of four or more.

The results of this analysis are perhaps not as valid as those discussed in the previous section given the relatively small sample sizes that result from splitting the data into these two groups (approximately 20 in each). However, it is important to consider the relationship between firm size and location factors, and thus the results are presented, albeit with a cautionary note.

Access to skilled workers, proximity to suppliers are seen to be more important to smaller firms, and smaller firms were more satisfied with proximity to rail intermodal facilities. Larger firms were more satisfied than smaller firms concerning a pro-business regulatory environment, as well as trailer parking. The number of dock doors location factor stands out as being more important for larger firms, and these firms being more satisfied with this location factor. This may indicate that operations, such as cross docking, which would be more sensitive to the number of dock doors, is taking place at larger firms, while smaller firms are not handling goods that are as time sensitive. On the other hand, proximity to the airport is seen as more important by smaller firms; as well, smaller firms being more satisfied with this location factor. This possibly indicates that air cargo travels through smaller facilities, and that there is more opportunity near airports for smaller firms to locate, especially close to Pearson airport in Mississauga. The freight forwarder composition of the sample is another reason for airports to be ranked more highly for smaller firms. Lastly, the importance of LCVs is ranked more highly by large companies in the sample than smaller firms, which is understandable in light of their characteristics.

Table 4-4: Differences between Large and Small Businesses

	Large Companies (those with over 100,000sqft)				Small Companies (those with under 100,000sqft)					
	Average of Importance	Average of Satisfaction	Rank Importance	Rank Satisfaction	Average of Importance	Average of Satisfaction	Rank Importance	Rank Satisfaction	Difference in Importance Rank	Difference in Satisfaction Rank
Ability to operate 24/7	4.05	4.14	1	1	3.59	4.00	4	2	3	1
Low land costs/tax rates	3.86	2.95	2	14	4.05	2.60	1	17	1	3
Number of dock doors	3.77	3.23	3	8	2.86	2.65	10	16	7	8
Trailer Parking	3.77	3.64	6	4	2.91	3.00	9	9	3	5
Access to major customers	3.77	3.68	5	3	3.32	3.45	7	5	2	2
Proximity to Highways	3.77	3.77	4	2	3.73	4.00	3	1	1	1
Availability of Skilled Workers	3.64	3.55	7	6	3.82	3.10	2	8	5	2
Pro-business regulatory environment	3.48	3.24	8	7	3.43	2.84	5	14	3	7
Truck Staging Areas	3.41	3.14	9	11	2.77	2.90	11	10	2	1
Access to major suppliers	3.23	3.59	10	5	3.36	3.62	6	4	4	1
Public Transit Availability	3.09	3.00	11	13	2.77	2.86	12	11	1	2
Availability of Unskilled Workers	2.91	3.18	12	10	2.32	2.85	14	12	2	2
Land available for expansion	2.82	2.14	13	19	2.36	2.05	13	19	0	0
Rail Intermodal Facility	2.81	2.81	14	16	2.23	3.10	16	7	2	9
Long Combination Vehicle Accessibility	2.55	2.59	15	17	1.86	2.55	19	18	4	1
Airport	2.48	3.19	16	9	3.27	3.71	8	3	8	6
Sea Port	2.33	2.38	17	18	2.18	2.76	17	15	0	3
Proximity to other similar businesses	2.23	3.05	19	12	2.27	3.10	15	6	4	6
Highway Visibility	2.23	2.82	18	15	2.05	2.85	18	13	0	2

4.2.4 Push/Retain Factors

There is a relationship between the two questions relating to each location factor. This relationship is explored by comparing the means of the two questions, importance and satisfaction with each location factor. If the cases were shown not to be significantly different, according to a matched-pairs t-test, they were placed either in the top left or bottom right quadrant of Table 4-5, according to the average importance. If the two responses for a factor (i.e., importance and satisfaction) were found to be significantly different, then they were placed in the bottom left (where the importance was more than the satisfaction with the factor) or the top right quadrant, where the importance was less than the satisfaction.

These four different classifications are summarized in Table 4-5, each with a different hypothesized impact. For instance, when the importance of the factor is low, and the satisfaction is rated low, then it would be expected that this factor has a no real impact on either pushing a firm from a location or in retaining the firm in that location. When the importance is low but the satisfaction with this factor is high, then the factor may have a slight retaining quality because in the future the firm may utilize this location factor. However, this may be in contrast to the reality of the sector as observers have noted that increasingly the nature of logistics firms operations are to lease rather than own buildings, and shortening their planning horizons (Supply Chain Brain, 2010). The high importance – high satisfaction combination are those location factors which will likely retain firms in their current location. Finally, the location factors that were of high importance but participants were not satisfied with them will be classified as 'push' factors, giving reasons for firms to leave their current location.

To confirm the differences between 'push' and 'retain' factors, further analysis was conducted to ascertain whether there was in fact a difference between importance and satisfaction. This was done by organizing variables according to 'very' or 'extremely' important, or not; and 'more than adequate' or 'excellent' satisfaction, or not with each location factor. These binary variables were then compared in contingency tables using McNemar's test. In most cases, this additional analysis confirmed that of the matched-pairs t-test for 'push' factors, and the significances found for each location factor can be viewed in Appendix B – Results.

Table 4-5: Exploring the Relationship between Importance and Satisfaction for all firms

	Low Satisfaction with Factor	High Satisfaction with Factor
Low Importance	*Neutral effect* • Long Combination Vehicle Accessibility • Sea Port • Public Transit Availability*	*Slightly Retain* • Proximity to other similar businesses • Highway Visibility • Airport • Rail Intermodal Facility • Availability of Unskilled Workers
High Importance	*Push Factors* • Low land costs/tax rates • Availability of Skilled Workers • Pro-business regulatory environment • Number of dock doors • Land available for expansion**	*Retain Factors* • Access to major suppliers • Ability to operate 24/7 • Proximity to Highways • Trailer Parking • Access to major customers • Truck Staging Areas*

*These location factors have a mean importance close to 3 meaning that they have neither high nor low importance.
**This factor was not found to be different according to McNemar's test.

The most interesting location factors are those with high importance. These are the location factors that will likely guide firms' decision making processes, and ultimately determine their location. However, some of the factors that were not rated highly by respondents should be mentioned. For instance, airports and rail intermodal facilities are not rated as highly as would be thought. Distance to airports was found as a significant variable by Sivitanidou (1996), and Warffemius (2007) found that clusters developed around the Schiphol airport in Amsterdam. Here the distinction between site selection and network design may become apparent. While firms may value the importance of an airport or rail intermodal facility existing within the region that they locate in, they see other location factors as more important for their site selection procedures. So while other literature, and indeed recent evidence of logistics clusters occurring around multi-modal connections (CentrePort Canada, 2010; CN Rail, 2010; The Allen Group, 2009), this research suggests that the presence of these connections may not be sufficient to attract logistics businesses in and of themselves.

The location factors that are of high importance are found on the bottom of Table 4-5, and a more detailed description of the values and analysis of this table is found in Appendix B – Results. Here they have been separated into two groups, those that respondents were satisfied with and those they are not satisfied with. These factors can be of particular interest to municipalities that wish to attract or retain logistics businesses within their municipalities, and

for regional planners that hope to reduce freight sprawl into neighbouring communities. Some of these factors are identified well in literature on both generic industrial and logistics firms, but others are more site-specific in nature and have not been addressed to the same extent.

For example, 'push' factors such as the number of dock doors and land available for expansion are site specific variables that are addressed through zoning and creation of parcels for industrial land at a plan of subdivision level of planning. Low land costs and tax rates are addressed at the municipal level and land costs in particular are somewhat influenced by the public sector. A pro-business regulatory environment is a location factor that can be addressed by all levels of government. The availability of skilled workers is also a variable that is hard to address because of its multi-faceted nature, and can be encouraged by various levels of government as well. Of the 'retain' factors, access to suppliers and customers are often the result of a firm's network design, and influenced mostly internally by the structure of the supply chain. Trailer parking and truck staging areas are zoning issues, along with proximity to highways. The ability to operate 24/7 was ranked very highly and also firms were satisfied with the provision of this type of operational environment.

4.2.5 Large versus Small Firms - Push/Pull Factors

These are characteristics that are being analyzed across the entire sample but when splitting the sample into small and large firms some interesting differences emerge. First, there are more factors that are seen to be important by large firms as opposed to smaller firms. Either this list of location factors is more applicable for larger firms than for smaller ones or larger firms have more capacity to obtain locations that are more appropriate to their needs. Also, with the exception of 24/7 operations, smaller firms do not have site specific variables such as trailer parking, or truck staging areas listed as important. Interesting differences between large and small firms include that public transit availability and land being available for expansion are two variables that are more important for large firms than for small ones. Conversely, the airport is an important variable for smaller firms but not for larger ones. These differences can be seen in Table 4-6 and Table 4-7.

Table 4-6: Exploring the Relationship between Importance and Satisfaction for Small Firms

	Low Satisfaction with Factor	High Satisfaction with Factor
Low Importance	*Neutral effect* • Trailer Parking • Number of dock doors • Truck Staging Areas • Public Transit Availability • Land available for expansion • Availability of Unskilled Workers	*Slightly Retain* • Sea Port • Long Combination Vehicle Accessibility • Highway Visibility • Proximity to other similar businesses • Rail Intermodal Facility
High Importance	*Push Factors* • Low land costs/tax rates • Availability of Skilled Workers • Pro-business regulatory environment**	*Retain Factors* • Proximity to Highways • Ability to operate 24/7 • Access to major suppliers • Access to major customers • Airport

**This factor was not found to be different according to McNemar's test.

Table 4-7: Exploring the Relationship between Importance and Satisfaction for Large Firms

	Low Satisfaction with Factor	High Satisfaction with Factor
Low Importance	*Neutral effect* • Availability of Unskilled Workers • Rail Intermodal Facility • Long Combination Vehicle Accessibility • Sea Port	*Slightly Retain* • Highway Visibility • Airport • Proximity to other similar businesses
High Importance	*Push Factors* • Low land costs/tax rates • Land available for expansion • Number of dock doors**	*Retain Factors* • Ability to operate 24/7 • Trailer Parking • Access to major customers • Proximity to Highways • Availability of Skilled Workers • Pro-business regulatory environment • Truck Staging Areas • Access to major suppliers • Public Transit Availability

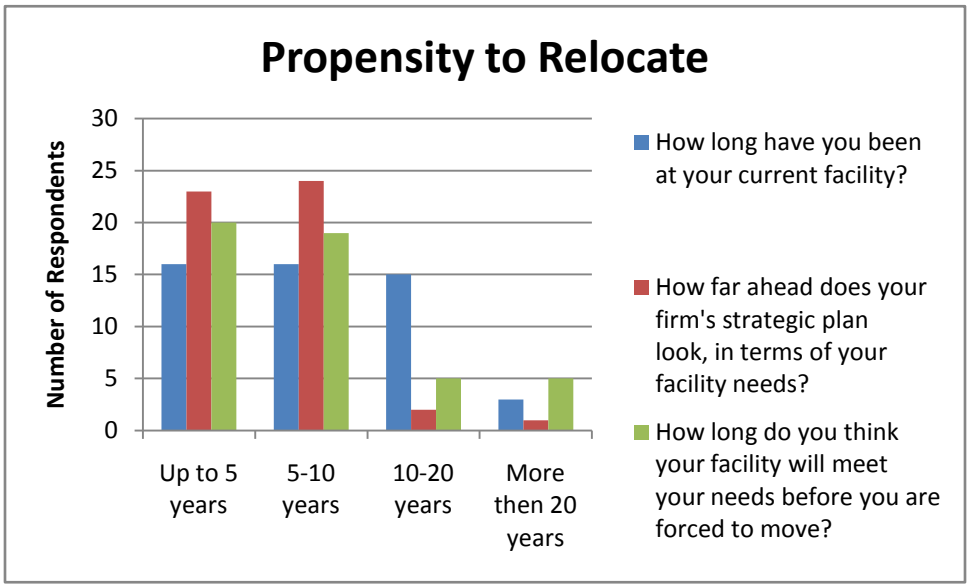
**This factor was not found to be different according to McNemar's test.

4.2.6 Affect of Factors on Propensity to Relocate

The literature notes that firms are moving towards having shorter planning cycles for their facilities and this is being supported by firms moving towards leasing of facilities as opposed to owning them (Hesse, 2004, 2008). The survey asked questions about how long participants have been at a current facility, as well as how far ahead they plan and when they will

be forced to move. From Figure 4-22 below, we can see that the vast majority of participants do not look farther then 10 years ahead in terms of their strategic planning, as well as not envisioning themselves being located in the same location for more than 10 years. This is consistent with the literature mentioned previously. This is in contrast to strategic planning in the public sector which will generally look farther into the future than logistics firms.

Figure 4-22: Propensity to Relocate



To determine whether a relationship exists between any of the location factors and their propensity to relocate, each location factor was converted to a binary variable corresponding to 'very important' or 'extremely important' indicating importance and 'not important at all', 'slightly important' or 'moderately important' indicating that the variable is not important. The propensity to relocate factors were changed to either up to five years, or more than five years. Cross tabulations were performed on all the location factors and the resulting table can been seen in Appendix B – Results.

The vast majority of the location factors did not show that an uneven distribution was present between the two variables. There were two variables that were significantly different at the 95% level of confidence. For instance, if participants were very or extremely satisfied with the number of dock doors that they had, then they will stay at that location longer than if they were not. Another variable that was found to be significant was the importance of proximity to customers. If participants found access to customers to be of high importance than they would

tend to stay longer in the location that they are in, presumably to maintain a close proximity to those customers that they need to be close to.

Significant or almost significant at the 90% level of confidence using Fisher's exact test were importance and satisfaction with proximity to highways (p-values of 0.08 and 0.10), and satisfaction with access to major suppliers (p-value = 0.10). Again, findings show that if participants suggested proximity to highways to be important, then they would not be as likely to relocate within five years. They find this location factor tying them to a location, albeit less strongly than the number of dock doors. The importance of the number of dock doors in this analysis could be due to the relationship between this variable and the throughput of the facility. When a firm is growing, this analysis suggests that the number of dock doors is an important determinant of the firm out growing its facility. In terms of satisfaction with highways, if participants were not very or extremely satisfied with proximity to highways then they did not indicate that they would stay at that location for more than five years, and the same is true for access to suppliers. However, these results were not found to have the same level of significance as the aforementioned variables, mainly the number of dock doors and access to customers. So while a strong relationship between the ratings of many variables and participants propensity to relocate was not found, there was a strong relationship found between the number of dock doors (p-value = 0.02), and access to customers (p-value = 0.02), and a logistics firm's propensity to relocate, which were the only variables found to be significant at a 95% level of confidence.

4.2.7 Planning Issues

The respondents also mentioned specific planning related issues related to their sites in the survey results. Participants were asked whether one of four specific planning issues were related to their facility site. Options included: no Truck Routes (mentioned by 2 participants), operating restrictions at night (mentioned by 4), too many auto parking spots required by bylaws (mentioned by 4) or problems with parked trailers classified as outside storage (mentioned by 2). Of these respondents, one indicated having problems with both operating restrictions at night and problems with parked trailers. The options provided in the survey were identified through studies conducted over the past ten years in the Greater Toronto Area (Canadian Urban Institute, 2000; iTrans Consulting, 2004).

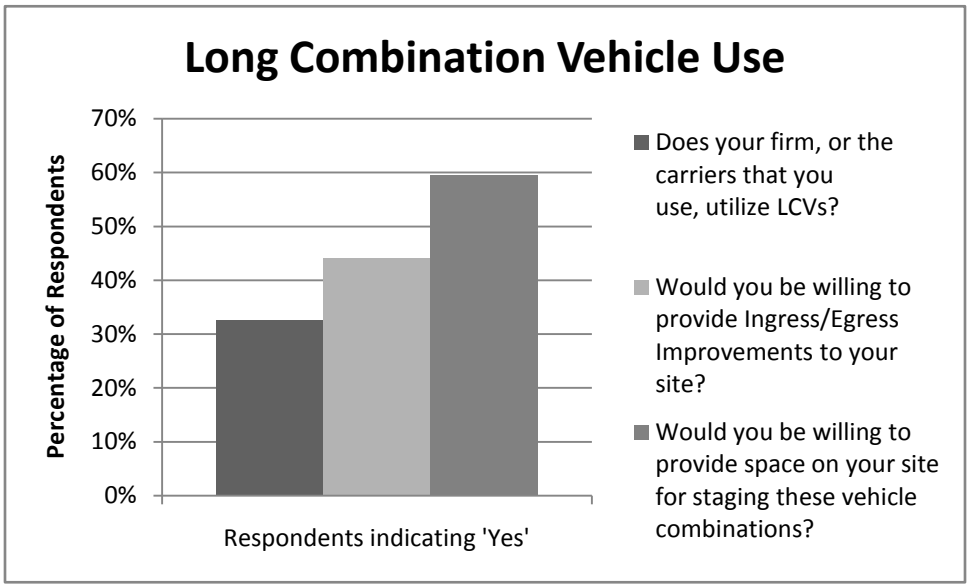
4.2.8 LCVs

One of the secondary research objectives was to explore the impact of LCVs on the location choices of logistics firms. While in terms of importance, LCVs were not valued very highly as seen earlier in this chapter, results do show that large firms value LCV access more than smaller firms. Figure 4-23 shows other questions that were posed to participants. They responded to three questions that were meant to gauge their interest in the use of LCVs, including whether they used, or their carriers used LCVs, whether they would be willing to improve ingress/egress access to their sites, and whether they would be willing to allow for staging of LCVs on their site.

Of the 16 respondents that indicated that they use LCVs, 12 are located within the GTA. The other four are located in Alberta and Quebec. Considering that the Ontario Ministry of Transportation has only granted two permits each to 50 firms within the confines of the LCV pilot project shows that there is a good representation of LCV users within survey results (Ontario Ministry of Transportation, 2009). Additionally, because 33% of the respondents indicated that they use LCVs, this indicates that the industry is aware of the capabilities of these vehicle combinations.

Examining responses to other questions concerning LCVs, 59% of participants indicated a willingness to provide room for LCVs to be staged on their site, an action that would be very inexpensive. But 44% indicated a willingness to pay for improvements to ingress/egress to their site to accommodate these vehicle combinations. So while one-third of participants are already using LCVs in some form, 60% are willing to accommodate them to some extent, but a lower percentage would be willing to pay for this accomodation (44%).

Figure 4-23: Questions regarding LCVs



4.2.9 Summary

There have been many findings of significance discussed here. Ranking the relative importance of location factors has indicated the necessity of a robust operating environment. Combining the importance and satisfaction factors has given a new type of insight into how location factors can be viewed and analyzed, especially within the context of logistics firms, and can work to the benefit of economic development officers who can allocate resources appropriately based on the effect that a location factor is having upon a business. The methodology that has been used may be able to be utilized for this purpose in other industries as well.

Large and small logistics businesses have indicated that the relative importance of location factors in a slightly different manner. The importance of specific site characteristics was found to be more relevant for larger firms, while smaller firms indicated that proximity to the airport was more important. LCVs appear to have a good reception in terms of use, although respondents did not indicate a majority willingness to pay for improvements that would facilitate the use of LCVs on their sites. The implications of this could be that the success of LCVs in Ontario may be dependent on the willingness of large carriers who operate them to obtain LCV access to highways, or to construct staging areas on, or adjacent to provincial highways that would be operated by governments.

4.3 Interview Results

Within the survey that was conducted, survey participants were asked if they could participate in a short phone interview and subsequently, ten individuals were interviewed. While the results of the survey allowed for specific categorization of the relative importance of location factors, the interview results provide insights into broader themes surrounding siting logistics facilities. Additionally, interview results allow for triangulation of results between different methods.

This section will examine facility location influences that were discussed by participants on a thematic basis. A discussion of aspects of spatial transaction costs that influence facility locations will be discussed, along with congestion impacts, relative locations to customers and suppliers, labour needs and the impact of agglomerations on the logistics industry. Along with these higher spatial scale considerations, site selection considerations including the impacts of various municipal bylaws on site selection will be outlined. A summary of the issues are presented in Table 4-8.

Table 4-8: Summary of Qualitative Findings

Summary of Findings		Discussed in Literature?
Spatial transaction Costs	Increasing trend of a responsive supply chain, driven by tight delivery time requirements, including fines	Confirms
	Proximity to Airports is critical for freight forwarders	Confirms
	Proximity to courier hubs for speed of cut-off times for delivery	Elaborates
	Fuel costs will not influence facility locations because of willingness to pay fuel surcharges	Not Mentioned
	Decrease in reliance on air for international transportation	Not Mentioned
	Firms will do optimization studies for site selection, then not implement results	Not Mentioned
Relative location to Customers and Suppliers	Proximity to customers more important than to suppliers	Confirms
	Proximity to Airports is critical for freight forwarders	Confirms
	Proximity to courier hubs important for making cut-off times for delivery	Not Mentioned
	3PLs will centralize multi-client facilities	Not Mentioned
Congestion	Chronic congestion will cause facilities to be located closer to their customers	Confirms
	One respondent moved from Oakville to Guelph, a primary consideration was to avoid traffic on QEW	Confirms
	Toronto isn't a city like new York, where the operational environment dictates that deliveries be handled by local companies	Not Mentioned
Intermodal	Rail services are unreliable	Confirms
	Rail serves primarily inbound transportation	Not Mentioned
	Proximity to rail intermodal facilities not very important	Somewhat Contrary
	Proximity to Hamilton airport not critical, cut-off times are at night, international movements are through Pearson	Not Mentioned
Site Characteristic Needs	Parking requirements don't take into account actual needs of businesses	Confirms
	Problems with trailers as 'outside storage'	Confirms
Zoning/ Operational Requirements	Road Geometry problems, especially in Toronto	Confirms
	Mississauga and Toronto "Don't want us here"	Elaborates
	Want flexibility to increase/decrease shifts and traffic and business increases/decreases	Elaborates
	Planners do a poor job in segregating uses, leading to potential conflict	Elaborates
Labour	Labour force will tie a firm to its location, except for some carriers who hire O/O	Elaborates
	Hours of Service regulations and truck driver demographics will result in an increase in the number of facilities	Not Mentioned
	Local Sales force can be a deciding factor in keeping facilities open	Not Mentioned
	'Unskilled' labour is valuable due to the amount of training that is required	Somewhat Contrary
Agglomeration	Need to be close to marketplace is crucial in keeping firms within the built environment	Elaborates
	Locating in periphery will reduce costs, but is associated with an increase in transportation costs and responsiveness	Elaborates
	Logistics Campuses as a way to share/reduce transportation costs	Elaborates

4.3.1 Spatial Transaction costs

Participants confirmed observations found in the literature that transportation costs in and of themselves do not incorporate the importance of quick and reliable deliveries, which have a higher impact on siting considerations. Specific causalities that have not been discussed in the literature were explained by participants. For example, there were several comments made regarding the impacts of fuel surcharges on their operations, which can be seen as a proxy for estimating the changing cost of transportation. Participants mentioned that fuel surcharges, even those large increases that that were seen in 2007-2008, will not necessarily have an impact upon the number of facilities a firm may locate although fuel prices may have other impacts. Instead, proximity to customers was cited as the deciding factor for many participants, especially those involved with retail distribution. Where fuel price increases may have an effect was speculated upon by one participant who represented a freight forwarding concern. As a result of the price hikes of a couple of years ago, he has seen a decrease in air traffic, and speculated that into the future the use of air transport will be 'merely a safety valve' for those consumer goods other than those that absolutely have to travel by air, such as some foodstuffs and flowers.

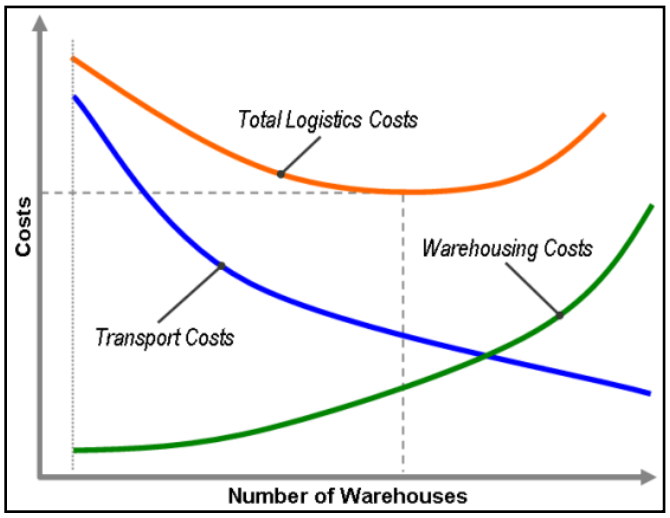
Responses to questions about the impacts of fuel surcharges ranged from no perceived impact because of a willingness to pay fuel surcharges by customers to speculations by participants of a gradual shift from the use of more intensive to less energy intensive modes. Also, participants stressed that the impacts of higher fuel prices would be highly dependent on the characteristics of a commodity. For goods where the price of fuel makes up a large portion of the final price of the good, the impact of higher fuel prices on the supply chain that delivers that good may be high. In contrast, goods where the transportation component of the final price of the good is small, the impact of higher fuel prices will be minimal. The perceived impact on the location of facilities within an urban area is perceived to be small.

Here we must consider the differences in how the supply chain is designed. While the network design of a supply chain will consider differences between modes and transportation costs on a macro scale, the site selection process, consisting of choosing a site within a particular region will not usually consider cost savings that could be made through locating facilities within different areas of the same region. Within the literature it is noted that there is a lack of

integration of tactical and operational level considerations such as routing into network design optimization (Ambrosino & Scutellà, 2005; Melo et al., 2009). To optimize a network that will incorporate decision making at all levels is difficult as knowledge of future requirements is dependent on business requirements and customer demands into the uncertain future. In spite of these comments, one participant mentioned specifically that when contemplating the expansion of their supply chain, they conducted their strategic network planning while taking into account operational level issues like routing because they had a specific network of customers that they could count on into the future.

Within this context, the need for a responsive supply chain will guide the development of facility locations to a larger extent than transportation costs. A responsive supply chain is one where inventories are low, and goods will move quickly from manufacturer to customer. The industry that a supply chain is serving is critical in determining how responsive that supply chain should be. For instance, there is a spectrum of how responsive a supply chain has to be and different industries move along this spectrum according to the needs of their customers. Generally, the recent past and trends that participants see into the future is a move towards more responsive supply chains. Theoretically this will result in fewer facilities within an entire network, and a higher transportation cost, which is the same as saying a higher amount of vehicle kilometres travelled. This relationship between supply chain costs can be seen in Figure 4-24. Indeed, one participant mentioned that a company will first ask itself 'how responsive do you want your system to be?' and then design the appropriate amount of facilities accordingly. This does change over time in both directions of responsiveness, as the same participant discussed how in the 1970s the trend in automotive distribution was to increase the number of distribution centres to save on transportation costs. Today the trend for retail distribution is to increase the responsiveness of supply chains, and demands for higher levels of reliability, in conjunction with increasingly smaller, more frequent deliveries. This demand by retailers for more reliability has teeth, in that the responsiveness that is being demanded is increasingly underpinned by large fines for missed delivery windows.

Figure 4-24: Total Logistics Costs



Source: (Rodrigue et al., 2006)

4.3.2 Decision Making

Decision making at the firm level has led to the structure of the supply chain, and subsequent facility locations that we see today. Location factors are incorporated into this decision making process but it should be kept in mind that the ultimate decision for locating facilities rests with the corporate decision maker in the firm that is siting the facility. All of the results discussed here, both from the survey and the interviews should be interpreted within this context. It is the decision maker that will sift through the variety of qualitative and quantitative data that is provided to them by their supporting staff, and then make both network design and site selection decisions based not only on this data, but also on their perception of this data. Also, decision making methodologies discussed in the literature may influence how the decision is made.

Personal perceptions of the site selection process should be considered as extremely important, especially for smaller and less sophisticated medium and even large firms. Holl (2004) describes how a major consideration for the siting of smaller food companies is the location of the owner's home. A participant in this study discussed that 20 years ago, when his firm used much less sophisticated methods for site selection processes, the process would involve the owner of the firm flying his small airplane around the region and saying 'that's where I want it.' Each decision maker, or group of decision makers, will site their facilities

based on the knowledge they have of their industry, and their perception. Because of this, the level of scientific backing to their decision will vary from firm to firm, and from individual to individual.

The process of making decisions within firms can also have an impact on the ultimate location choice as discussed previously. Three participants who represented 3PLs observed that their customers will undertake extensive optimization studies, through which they will decide the optimal location for facilities through pre-determined criteria deemed important for that firm. However, upon completion of these studies, the information can be disregarded by the executive decision-maker in the firm, and often transportation inefficiencies result. The disregard of optimization exercises was noted to be more prevalent among firms whose parent companies are foreign based. On the other hand, two participants specifically mentioned that they do include considerations such as vehicle routing into their facility planning process. With limited responses available for analysis, it is unclear what generalizations can be made about the inclusion of optimization studies into the facility siting process. However, some firms will weigh other factors more importantly then the minimization of transportation costs. This may be a concern from a public standpoint since this could conceivably lead to higher vehicle kilometres of travel, and is generally inefficient.

For example, eastern Ontario is beginning to be seen as a good potential site for logistics because of two reasons; its central location for firms serving all of eastern Canada, and its low land costs. One participant discussed how her firm considered moving their warehouse operations to Cornwall, within eastern Ontario, but found that the drawbacks of breaking up the administrative and warehousing components of their business outweighed the potential savings of putting their warehouse in Cornwall. Another barrier to relocation noted by participants was the length of time that a company has been at a particular location. Just by being at a particular location for enough time, a firm will have a harder time leaving that location with labour force considerations being an important part of the explanation.

4.3.3 Municipal and Land Issues

Industrial properties that are geared towards logistics developments are today being built by land speculators who build facilities that will be used by the logistics industry. This is also

beneficial to the logistics industry as increasingly there is a tendency to lease or rent facilities rather than to purchase them. This has been noted within the literature but also was stated by participants in the interview portion of the study (Hesse, 2004). Also, participants discussed that the payment of development charges within the GTA are another reason why logistics firms today will not usually buy their own property. This trend may have resulted in the siting of some sub-optimal facilities, from a network design perspective as land speculators who have built warehouses do not necessarily place them in the most appropriate locations. One respondent noted that American land speculators had come and 'built up Bolton', a smaller community north of Brampton. He described how this location was not necessarily optimal because there is only one access road in and out of the community that is easily accessible by truck traffic. This would be an example of a 'non-robust' operating environment, and the development of land here by speculators may necessitate infrastructure investment by governments that would not otherwise be needed in the future.

As low land costs/land costs were identified by participants as one of the most important location factors there were points of interest put forth by participants during interviews explaining this rating. For example, of taxes that are levied by municipalities, land transfer taxes were seen as more of an impediment to siting a facility than property tax rates. It was noted that in the Ontario context, municipalities that are outlying will have lower land transfer taxes than GTA municipalities, with specific examples of Woodstock and Brantford being more affordable than Hamilton.

The availability of land is also an important factor for locating logistics firms and was identified as a potential 'push' factor through the survey portion of this study. Participants discussed how currently there are many sites available in the Toronto area due to the economic downturn, and they talked about having no problems acquiring sites. When asked about the future, participants usually did not elaborate past a few years into the future in their predictions. This trait is reflected in the literature and in the survey results of this study. Planning horizons for logistics firms are usually not greater than a few years into the future (Hesse, 2008).

An example given for a particular area in Toronto was concerning the suburb of Scarbourgh. One respondent noted locating in this area would be desirable because of the availability of labour, but that there is no available land. Furthermore, there are negative

perceptions of the logistics industry which will have an effect on the appeal of a particular place to the logistics industry. Generally, participants recognized that although they pay property taxes, they do not employ very many people relative to their size. Because of this participants understood that they tend not to be welcome in many communities; specifically mentioned were Toronto and Mississauga.

Also, the importance of a 24/7 operating environment was elaborated on during the interviews. There were a few specific locations that were mentioned as problematic; mainly the Mississauga Rd. and Highway 401 industrial area in Mississauga, and one interviewee from western Canada mentioned the Edmonton suburb of Sherwood Park. Participants explained that they needed to have the flexibility to increase and decrease operations at their facilities in coordination with the ebbs and flows of the economy. Additionally, it is not only the operating environment on the site itself, but access to highways from facility locations that is an important part of the operating environment. Most participants discussed that planners do a poor job in segregating uses and that even if their facility is not in conflict with other residents, they are aware of other sites that are in conflict.

There are other issues that are directly influenced by municipal governments that are important in maintaining an operating environment that is beneficial for logistics firms. These are issues that were identified in the literature and included in the survey, such as the importance of outdoor storage for trailers, a requirement for JIT deliveries, auto parking requirements that generally overestimate the need for auto parking on logistics sites, and road geometry that is friendlier to truck movements. The differing scope of interests in freight movements discussed earlier in the paper became apparent through these discussions. For instance, participants generally stated that they did not concern themselves with issues at a municipal level often, and that they were much more familiar in dealing with the federal, and to a lesser extent, provincial government due to customs and trade related programs.

4.3.4 Proximity to customers and suppliers

The relative importance of proximity to customers versus suppliers are location factors that will have an impact on the design of the firm's supply chain, and realized outcomes of differing patterns of firm locations. It has been noted that the tendency will be to locate closer to

customers because of the desire for quick cut-off times, but as far away as possible from high land values (Hesse, 2008). The importance of cut-off times was reiterated many times by participants. Proximity to courier hubs to take advantage of their cut-off times and to the airport were seen as critical considerations for locating sites by two participants. 3PLs can operate in two different ways: they can operate a facility dedicated for one client; or they can utilize the same facility to serve many clients. Only one participant commented on the differences between siting these kinds of 3PL facilities, where for the former they will work with the client to select a facility for that suits them, for the latter facilities are sited based on serving perceived critical Canadian markets, Toronto and Calgary.

4.3.5 Multi-modal Facilities

The growth of interest in inland ports and associated logistics developments supposes that firms cluster around inland ports to take advantage of rail and air services (Cidell, 2009). However, respondents did not weigh proximity to rail intermodal yards heavily, although participants saw an importance in regional availability of rail intermodal yards. The reasoning was that rail services provided their inbound transportation, which was not as time-sensitive as outbound, and as one respondent put it 'why locate next to a rail facility, drayage costs are [a flat rate] across the GTA.' Because of this, respondents were not strongly drawn towards rail intermodal yards. Another reason being that cut-off times for rail intermodal departures are known at least a day in advance. From a public standpoint this is another example of a sub-optimal consideration as firms do not consider distance as important, leading to a possible increase in vehicle kilometres. However, respondents noted indirect affects whereby large rail yards attract transportation support services, and these in turn will attract logistics businesses. So in fact the attraction to locate nearby intermodal facilities may be occurring, but not because of the intermodal yard itself, but because of the ancillary services that it attracts.

Using rail services was also seen as risky by participants because of their perceived unreliability. Examples were many of experiencing poor customer service by railways, including a railway losing a railcar containing a firm's goods somewhere in their system for over a month. One participant even stated that 'if you know anyone that has had a good experience with a railway, let me know.' These comments are confirmed by the preliminary findings of the rail freight service review (Enns & Papineau-Couture, 2009).

Concerning airports, they were considered to be a benefit on a regional basis, as are rail intermodal facilities. There was a worthwhile anecdote told by a participant that relates to the Seaton airport, a longstanding project in Ontario to develop another airport on the east side of the GTA. One participant, who is located in Whitby on the east side of the GTA, used Hamilton airport to distribute some outbound goods flows. This involved trucking their goods to Hamilton airport. Now, the proposed Seaton airport in Pickering would be built to attract this type of traffic to the area. The participant, while stating that his firm would most likely use the Seaton airport if it was built, said that the benefits for the firm would not be as great as they are being made out to be because all of the inbound flows coming from overseas will pass through Pearson airport regardless. Another participant, who is currently located in Hamilton, was asked about the propensity to relocate to the Hamilton Airport area now that both the Red Hill Creek expressway, a ring road around Hamilton is completed, and a direct access road to the airport area has been built. Interestingly, the participant said that his firm would not consider moving to this area because it does not directly abut the highway corridor that his firm uses (Highway 403).

4.3.6 Labour

The availability and quality of the labour force was seen as an important location factor for the participants, almost without exception. Interestingly, labour that would be classified as 'unskilled' was seen as quite valuable by some respondents because of the amount of investment in this human capital. This would include forklift operators and others. Another participant mentioned that unskilled workers had to be paid a decent wage because of the responsibility that they have in ensuring a safe work environment, and attempts to keep worker's compensation claims down. Where 'unskilled' workers were not seen as valuable was in simple picking operations to some extent, where they could be supplied by a labour agency; or the case of a participant who is not tied to the location of his employees because most are truck drivers who took their trucks home. The structure of the labour force that is described in the literature focuses on administrative staff and warehouse workers (Canadian Urban Institute, 2000). However, one respondent mentioned that the very existence of a facility gives a local sales staff a base to work from, and in some logistics sectors this is an important consideration. Additionally, another labour restriction appears to be having an effect on the network design of facilities of firms. The 'hours of service' regulations for truck drivers were made more stringent in Canada

in 2007, and this has had an effect on the number of facilities that need to be placed so that drivers can be back at their home facility within one day. Essentially, this regulation has increased transportation costs, and firms are looking at increasing their facilities to compensate for this change.

4.3.7 Congestion

The time scale of decision making for congestion mitigation strategies discussed by participants focused on strategic or operational level adaptations. One of the participants had moved out of the GTA from Oakville, leapfrogging the protected area that surrounds the GTA known as the greenbelt, to Guelph in the Wellington census division. One of the major reasons given by this participant was the motivation to be out of the congested QEW expressway corridor, to the relatively less congested Highway 401 corridor. Interestingly, this firm considered moving to Brantford as well, also outside of the greenbelt, but one reason against this choice was that access to the GTA from Brantford necessitates travel along the QEW corridor. Out of the ten participants, this participant's firm was the only one contacted that had moved outside of the GTA. So not only does the severe congestion along the QEW affect the location of firms along this corridor, but it may affect the ability of peripheral locations like Brantford to attract logistics development.

Within Toronto as well, one participant located in the western part of the GTA discussed the possibility of his firm in locating another warehouse on the east side in order to avoid congestion. This comment is a further indication of spatial transaction costs are being governed more by time then distance. This is underscored by participants' discussions of not being greatly influenced by fuel surcharges and the price of fuel, but being influenced by speed and reliability to markets. Indeed, strategies to increase reliability of delivery time included moving closer to customers, or closer to courier hubs. The size and congestion prevalent in a city region may also affect operation strategies. One respondent discussed that the sheer size and amount of congestion in the New York metropolitan area prevents GTA firms from performing deliveries there on their own, necessitating collaboration with New York companies. He speculated that if Toronto grows to a similar size, then the characteristics of firms will change as well.

4.3.8 Innovations and Speculations on the future

Several participants mentioned that often congestion and/or fuel price increases will lead to a rise in innovations and scheduling changes, which are operational level adaptations. This includes organizing driver's days around congested periods, or moving deliveries to the night time. One participant mentioned that major retailers are moving to night time 'unassisted' deliveries, where the driver is given a swipe card to access the customer's premises during the night and performs the delivery without the assistance of store employees. This strategy saves time during delivery, but also results in less truck trips to the store.

Further into the future, the concept of logistics campuses was explored by two interviewees. This would involve the co-location of vendors to major distribution centres, with these vendors sharing labour and facility costs, and then be able to ship smaller, more frequent deliveries to major distribution centres as they are required. This concept has one major barrier, as identified by participants, the sharing of transportation services results in a lack of control over a firm's goods which most are uncomfortable with. This presents an opportunity for the public sector to step in and provide a framework which can be used to create these campuses, which would have a large public benefit of reducing the amount of truck traffic on highways.

Concerning Long Combination Vehicles, the results of the interviews elaborated upon the results of the survey. While participants discussed that LCVs may become more of consideration into the future, they will never really come to near the top of the list of location factors because their use will be specialized to a few types of businesses, and because carriers can always arrange to stage LCVs off site, and consolidate different companies' goods into one LCV. One participant mentioned that he would rather see general infrastructure improvements then a focus on just LCVs.

4.3.9 Summary

Through the course of conducting interviews with logistics professionals, it is apparent that that there are varied reasons for logistics firms to make a location choice, and that their needs vary according to their business. Logistics firms operate within a specific framework of fulfilling the needs of their customers first, and design their supply chains accordingly. The results of the interviews may not be representative of the entire logistics firm population;

responses are dependent on the structure of the type of business and the size and nature of the urban area.

Findings from the interview portion of the survey helped to enrich survey findings in a number of ways. Discussions reiterated the importance of a 24/7 operating environment, and time to market was emphasised. Observations on the differing importance of proximity to rail intermodal facilities and airports are novel. Logistics firm strategies on dealing with congestion can be helpful for transportation planners looking to better understand how firms adapt in the increasingly congested GTA. Issues surrounding the location choices of logistics firms are complex with many layers of actors and there is opportunity to improve the knowledge of linkages between the characteristics of the built environment, the freight transportation sector, and public sector influences on these variables.

5 FINDINGS AND RECOMMENDATIONS

This chapter will present the findings of this thesis, answering the research questions explicitly, as well as discussing the implications of the findings. Additionally, recommendations will be made that incorporate the findings of the thesis for consideration by planners and economic development officers. Finally, concluding thoughts on this work will be discussed.

To return to the goals set out at the beginning of this thesis, the primary research question will be addressed. A reminder that the primary research question asks:

- What are the location factors relevant for logistics firms in the GGH and what are their relative levels of importance both quantitatively and qualitatively?

Secondary questions include:

- What planning relevant issues are associated with the siting and operations of logistics firms?
- What are the implications of Long Combination Vehicles upon facility locations?

One of the great strengths of mixed methods research is having the ability to triangulate results to add value to findings of both the quantitative and qualitative findings. To address the primary research question an extensive table (Table 5-1) has been prepared that describes what has been established in the literature, and findings from both stages of the study. In the final column, new findings, or findings that elaborate on what has been observed throughout the literature are emphasized.

Table 5-1: Triangulation of Findings

Location Factor	Literature	Reference	Quantitative	Qualitative	New Finding/ Contribution
Low land costs/tax rates	States that logistics firms usually look for less expensive land because of footprints needed	(iTrans Consulting, 2004; Yap & Rene, 2003)	*Push Factor*	Lower land costs will usually result in less responsiveness to customers. Trade-off between low land costs in periphery and responsiveness is made	• Confirms findings in literature
Ability to operate 24/7	Necessity of a 'robust' operating environment is stated	(Hesse, 2008; Hesse & Rodrigue, 2004)	*Retain Factor*	Emphasized that without this attribute, they cannot operate a logistics facility	• Importance of this location factor has not been emphasized
Proximity to Highways	True for many types of firms as well as logistics firms	(Bowen, 2008; Kawamura, 2001; Targa, Clifton, & Mahmassani, 2006)	*Retain Factor*	Proximity to Highways is important	• Confirms findings in literature
Availability of Skilled Workers	Access to skilled workers is becoming more important as industry increases automation	(Urban Land Institute, 2004)	*Push Factor*	Those that would be classed as 'unskilled' workers were seen as skilled because of amount of training they require	• Reflects known trend that skilled workers are becoming more important
Access to major customers	Proximity to customers is more important then suppliers, especially for smaller firms	(Hesse, 2008; Sivitanidou, 1996)	*Retain Factor:* Was a significant factor to predict moving from a location	1) Increasing trend of penalizing heavily for late deliveries. 2) Desire to be close to some facilities (like courier hubs) to take advantage of cut-off times late in the day	• Findings elaborate on why proximity to customers is so important
Pro-business regulatory environment	This is seen as being moderately important by some manufacturers in locating, logistics firms also consider this factor in their location decisions	(Barkley & McNamara, 1994; Hesse, 2008)	*Push Factor*	Some municipalities are seen as not being friendly to logistics firms, such as Toronto and Mississauga. It was noted that other municipalities are active in attempting to recruit businesses	• Confirms findings in literature
Trailer Parking	A reduction in the amount of floor space required by firms may be offset by more land being required for outside storage, and staging areas	(McKinnon, 2009)	*Retain Factor:* Site selection factors were ranked more highly by larger firms	Outside storage of trailers is necessary in a JIT environment	• Site Selection location factors more important to larger firms • Confirms that trailer parking, truck staging variables, etc. are necessary for a JIT environment

Location Factor	Literature	Reference	Quantitative	Qualitative	New Finding/ Contribution
Number of dock doors	Very important site consideration. Varies by type of logistics firm	(McKinnon, 2009; Yap & Rene, 2003)	*Push Factor:* Was a significant factor to predict moving from a location	This factor was not mentioned specifically by participants	• Not specifically mentioned in interviews, relationship with propensity to relocate shows its importance
Access to major suppliers	While access to suppliers is important, it is less important than access to customers	(Holl, 2004)	*Retain Factor*	Participants considered this factor as important, but speed to customers or outbound distribution hubs was considered more important	• Confirms findings in literature
Truck Staging Areas	See 'Trailer Parking'	(McKinnon, 2009)	*Retain Factor*	Was mentioned as a necessity of operating in a JIT environment	• Confirms that trailer parking, truck staging variables, etc. are necessary for a JIT environment
Public Transit Availability	Literature concentrates on how public transit can be used to reduce congestion, not necessarily as a location factor	(iTrans Consulting, 2004)	*Neutral Effect:* This factor is ranked as slightly more important to larger as opposed to smaller firms	Participants mentioned that for temporary workers, employment agencies arranged transportation for their workers to their site, so public transit was not an issue	• Public transit is not important for siting small facilities, slightly more important for large facilities • Employment agencies will arrange transportation
Airport	Airports are important for logistics firms as a location factor	(Bowen, 2008)	*Slightly Retain Factor:* Smaller firms rank airports higher	Close proximity to airports is important for some, such as freight forwarders, but are not extremely important for others	• Airports are not ranked as highly as expected • Are regional consideration, not site consideration
Availability of Unskilled Workers	As a facility adds more value-added functions to its operation, this factor increases in importance	(Yap & Rene, 2003)	*Slightly Retain*	Those that would be classed as 'unskilled' workers were seen as skilled because of amount of training they require	• Reflects known trend that skilled workers are becoming more important

Location Factor	Literature	Reference	Quantitative	Qualitative	New Finding/ Contribution
Land available for expansion	Identified as a push factor for firms that need to expand	(iTrans Consulting, 2004)	*Push Factor*	Parking requirements can reduce the ability of intensification of use on a site	• Zoning can affect parking requirements and this factor
Rail Intermodal Facility	Many examples exist of clusters of logistics firms occurring around intermodal facilities	(Hesse, 2008; Rodrigue, Comtois, & Slack, 2006)	*Slightly Retain Factor*	Is seen as important on a regional level, but close proximity is not important	• Rail intermodal facilities are not ranked as highly as expected • Are regional consideration, not site consideration
Sea Port	Not important	(Sivitanidou, 1996)	*Neutral Effect*	This factor was not mentioned by participants	• Confirms findings in literature
Proximity to other similar businesses	Close proximity is often outcome of location choices, not necessarily seen as important	(Hesse, 2008; Warffemius, 2007)	*Slightly Retain*	Logistics campuses were seen as a way for companies to reduce costs, problems with information sharing were acknowledged	• Opportunity for logistics campuses in GTA, especially for retail distribution
Long Combination Vehicle Accessibility	Not mentioned in literature as a location factor		*Neutral Effect:* But more important for larger firms	Not seen as an important location factor for participants	• Generally not important • Larger firms may see them as slightly more important
Highway Visibility	Mentioned as important by some participants (public cold storage) in one study	(Canadian Urban Institute, 2000)	*Slightly Retain*	This factor was not mentioned by participants	• Probably only important for certain public warehouses

There are several findings that can be seen in Table 5-1 that are unique to this study. These new findings add to the literature available on logistics facility locations and specifically the characteristics of the Canadian logistics industry. Key findings that are summarized here will not only address location factors specifically but larger themes that have been identified through the interview portion of the study.

5.1 Labour

There are several findings related to labour issues. Trends that are well known within the literature have been reiterated by participants. That unskilled workers are found to be less of a consideration in terms of location than skilled workers is established in the literature (Urban Land Institute, 2004), and this was found within both the survey and interview results. Also, general discussions confirmed that logistics firms employ low numbers of employees per square foot and therefore labour is less of a location consideration than for other industry sectors (Hesse, 2008; Sivitanidou, 1996; Yap & Rene, 2003). There were two observations that were specifically mentioned throughout the literature concerning the relative importance of skilled versus unskilled labour. 1) The observation that unskilled workers that are supplied by labour agencies will often have their transportation to the facility arranged by the agency further reducing their importance in location considerations, and 2) that because of the amount of training that 'unskilled' workers receive at a facility, they become viewed as very valuable employees and will ultimately contribute to retaining firms at a location.

With these two observations in mind, the categorization of 'skilled' versus 'unskilled' workers becomes problematic because of its subjective nature. Furthermore, sub-sectors of the logistics industry view workers differently, and the siting of a logistics facility takes into account workers that would not be thought to be important for logistics facility operations (such as salespeople and administrative staff). The combination of survey data which shows that skilled workers are more important than unskilled along with interview results which give descriptions of the reasons for this difference results in the relationship between the labour types becoming muddy. Elaborating on the issue of sales and administrative staff, co-location of the logistics and office functions of a business is another way in which labour becomes a 'retain' factor.

These explanatory responses build on the findings of (Holl, 2004) in his interviews of Spanish food companies, but this study did not find that the presence of the owner's home was a location factor as Holl reported. Lastly, a consideration that can be seen to be very specific to a quite recent development in Canada is the increasing consideration of Hours of Service regulations of truck drivers as being a consideration in the distance that is placed between facilities, as stricter regulations and labour shortages amongst truck drivers are making firms more cognizant of how to space facilities within their network. This observation was not mentioned throughout the literature.

Key Findings:	• **'Skilled' workers are seen as more important than 'unskilled' but subjective nature of these terms suggests that they should be more clearly defined** • **'Hours of service' potentially have an impact on network design of supply chains** • **Other workers, like sales and administrative staff act as a 'retain' factor as well**

These findings can be useful for economic development officers who wish to attract logistics firms to their region. The importance of labour considerations is considerable for logistics firms, and development of a logistics park will not be very successful if access to labour is unavailable. An important implication for future work is to clearly define between different labour delineations. The subjective manner in which 'skilled' and 'unskilled' workers were delineated by interviewees suggests that further research should specify what is meant by each categorization.

Key Recommendation:	• **Clearly define different levels of 'skilled' versus 'unskilled' workers in future study**

5.2 Relative Locations and Congestion

The location of logistics firms relative to their customers and suppliers is often determined through an optimization exercise. However, these exercises usually create an output that focuses on a particular region, not on a site within that region. While some research has been done on ways to optimize the site selection process within the larger network design exercise (Ambrosino & Scutellà, 2005) there is a general lack of integration of these two facility location processes within one optimization exercise. The primary reason is the amount of

uncertainty at the smaller level of decision making in terms of customers, suppliers and other factors. However, some observations were made concerning the relative importance of time and distance and results confirm that in modern supply chains, time is more important than distance (McKinnon, 1999). Because of this, the potential effects of congestion may include the restructuring of supply chains within a region, and changing the number and locations of facilities. For some firms this will result in more facilities being located closer to customers so that they can be served within strict delivery times demanded especially by larger retail firms like Wal-Mart. So instead of firms moving out of areas of congestion, they may be forced to move towards areas of congestion, or locate more facilities within a region to maintain delivery times.

This hypothesis is extremely contextual; proposed here are three conditions that would need to be satisfied to cause this situation. Firstly, the logistics firm must be involved in serving customers that demand rapid deliveries, and these customer's facilities must be located within the congested area. Secondly, the size of the urban region will dictate whether the increased time costs incurred by locating outside of the urban region outweigh the costs of operating within a less than ideal, congested environment. Thirdly, land costs within the congested area cannot be prohibitive for the firm. The GTA may satisfy these conditions for many firms, including seven of ten participants in this study who choose to stay within the urban boundaries of the GTA, therefore we may not see widespread relocations of logistics firms out of the GTA.

In spite of this hypothesis, there are the more observations from interviews that firms mostly deal with congestion by first undertaking operational level changes within their firms, and then only when the time comes to choose a new location does congestion becomes a strategic level consideration. This is consistent with findings from the literature (McKinnon, 1999). A finding that is important to consider, especially for economic development agencies is the importance of proximity to courier hubs to make cut off times late in the day. This consideration was held as extremely important by one respondent throughout the interview portion of the study, and mentioned by several others.

Key Findings:	• **Time is more important than distance** • **Proximity to customers is becoming more important**

5.2.1 Freight Sprawl and Intensification

This study has found that freight sprawl is occurring within some Canadian metropolitan areas, but this phenomenon has different characteristics in different Canadian regions. Throughout the analysis of business registry data, it became clear that there is a higher growth of logistics firms outside of the borders of the Vancouver region, with more development taking place in neighbouring Abbotsford-Mission. Within the Toronto area, rates of growth in logistics businesses were highest in Peel region, while outlying areas such as Brant and Waterloo regions were also showing growth, suggesting some freight sprawl is taking place. The location factor that can reflect these aggregate trends within the survey and interview is the importance of land costs to logistics businesses. Within the survey results, the high rank of low land costs shows that the logistics industry is very sensitive to expensive land costs. This perspective was confirmed through the interview results as well, with participants discussing how they can more easily move than other types of businesses and land costs being an important consideration.

From a planning standpoint, it makes sense to keep firms within the boundaries of the Greater Toronto area to minimize the need for more highway infrastructure and to reduce overall vehicle kilometres travelled. This is assuming that the majority of firms that wish to locate in the GTA have outbound flows destined for locations within the GTA. However, this is within the interest of the larger provincial planning scheme, focusing on the regional level of the GGH, rather than necessarily being within the interest of various municipalities and communities within the GGH. For instance, Brantford has been an economically depressed municipality for some time, and the attraction of logistics businesses has helped to provide employment in this community. However, this causes increased traffic on highway corridors leading to the Toronto area, which is the largest market in the region.

Now, it appears that there is a trade-off for the broader public that is being made without a full understanding of its benefits and drawbacks. For instance, reserving land within the urban area for logistics activities may reduce the amount of vehicle kms travelled upon area highways but will not allow that land to be developed for more intensive uses. And vice versa, reserving land for logistics firms within the urban boundary will reduce vehicle kms travelled to market, but also reduce the amount of land available in the urban area for other uses. A discussion

should be had about the costs and benefits of different logistics locations incorporating these broader perspectives, and the extent to which this relationship is true.

A final recommendation that has been established from discussions in this thesis on the increasing value of time is the environmental impact of responsiveness. Because of the increasing value of time, governments should be cautious about the restructuring of supply chains along more responsive lines. This is because more responsive supply chains will incur higher transport costs and therefore require more fuel. The recommendation here would be to engage in more research investigating how supply chains can be changed to make them less responsive and have this seen as a 'green' practice.

Key Recommendations:	• **Establish the pros and cons of freight locations from a public perspective** • **Further research should investigate the environmental impact of responsive supply chains**

5.3 Multi-Modal

Throughout the literature, proximity to multi-modal connections is described as an important consideration for logistics firms. This is especially true for airports, with proximity to rail facilities being seen as less important (Sivitanidou, 1996; Bowen, 2008). Findings here in regards to airports indicate that smaller firms consider proximity to airports more highly than larger firms.

The most important finding of this study in regard to multi-modal connections is that they are seen to be important from a network design rather than a site selection perspective. This is an extremely important finding as a number of municipalities aspire to attract economic growth through the creation of a logistics hub, often centred around an airport or rail intermodal facility. These logistics hubs often centred around rail intermodal facilities often strive for the co-location of logistics firms to take advantage of lower drayage costs. While many of these ports have been successful, this research shows that the success of these areas attracting logistics development is not because of the multi-modal infrastructure being in close proximity, but because of the availability of inexpensive land with access to a multi-modal facility as a bonus. So that multi-modal facilities cannot be the only attribute that a city has in order to attract logistics

development, it must also provide a development environment that has other location factors that logistic firms find to be valuable, or logistics development will just locate outside its borders. When the multi-modal facility is an airport, this study shows that some freight forwarding firms do not share the characteristics discussed, as these types of firms do consider site proximity to the airport as important to respond effectively to cut-off times for flights.

Key Finding:	• **Multi-Modal connections are important regional consideration but not important at the site level**

5.4 Site Characteristics and Planning

Interpretation of the findings discussed in this section will not only help to place site characteristic needs into the hierarchy of location factor importance, but has also addressed the secondary research question of exploring planning aspects. Site characteristics that have been examined in this research have not been extensively addressed in the academic literature. Publications by the Urban Land Institute (2004) and Yap and Rene (2003) have outlined various site requirements for the logistics industry and within the academic literature Rodrigue et al. (2006) and Hesse (2008) discuss the necessity for a robust operating environment. Within southern Ontario, two reports conducted concerning the logistics industry and goods movements have specified site characteristics necessary for the operation of logistics facilities and the findings from these studies have been investigated again here (see chapter 3) (Canadian Urban Institute, 2000; iTrans Consulting, 2004).

The most critical finding of this study, especially for planners has been the respondents' repeated insistence on the importance of the ability to operate 24/7. In both the survey and interview results, this location factor came up again and again as a critical consideration. The slightest encroachment on logistics operations by residential land uses that are not compatible was seen as a critical consideration in beginning to relocate. One participant specifically stated that "planners do a poor job in separating uses." As segregating conflicting uses is one of the most important tasks of planners this should give the profession some concern. Not only the operations on the site itself, but on roads leading from the site to highways, were seen as being very important to maintain as available for 24/7 operations, or the logistics operation was simply not feasible.

However, site characteristics were seen differently by large and small firms, and most site selection characteristics critical to large firms were not found in the survey to be as important for smaller firms. This includes location factors such as trailer parking, number of dock doors and truck staging areas. However, the ability to operate 24/7 was seen as very important by all firms, regardless of size. The number of dock doors, although not being seen as a characteristic important by small firms, was found to be a factor associated with a firm's propensity to relocate. Additionally, through the interview results, other factors mentioned such as having adequate trailer parking and truck staging areas are necessary for a JIT or QR operating environment. Also, the interview results elaborated on issues surrounding parking for automobiles. For example, one participant's site was zoned to have 250 parking spaces and yet only 35 people were employed at the facility. Municipalities should examine their parking requirements and possibly be more flexible when zoning for parking in industrial zones.

Key Findings:	• **Ability to operate 24/7 is an absolutely necessary operational requirement that cannot be compromised** • **Site Selection location factors more important to larger firms**

5.4.1 Site Characteristic Recommendations

The preceding findings discussed specific issues that were found through the course of interpretation of the survey and interview results. Recommendations will be suggested that focus around how the public sector can better address these concerns. Site characteristic issues found to be important were a need for appropriate number of dock doors, trailer parking, truck staging areas, and most importantly a 24/7 operating environment (see Figure 4-20). These findings confirm to a large extent studies conducted in southern Ontario over the past 10 years, and findings of this study showing many of the same deficiencies show that these issues should be addressed. Two different development guidelines for logistics firms will be discussed. Firstly, changes to the Ontario Ministry of Environment (MOE) land separation guidelines will be discussed. Discussions of freight-supportive land use guidelines as suggested by Gordon (2005) will follow.

The designation of distances that must be provided around industrial properties is done in Ontario by the Ministry of Environment through their D-6 land use guidelines (Ministry of Environment, 1995). These guidelines have not been updated since 1995, and logistics industries

would fall under the most noxious of the three classifications because of their 24/7 operations. If the guidelines were updated, then this research would suggest that a separate classification for logistics industries would be helpful in taking into account the specific operational requirements of the logistics industry.

Adoption of freight supportive land use principles as suggested by Gordon (2005) could be useful in providing guidance to planning professionals. Furthermore, the incorporation of information about the importance of a robust operating environment could help to better define the guidelines. Other site requirements were discussed in the previous chapter (4) as well, such as the treatment of trailers parked outside as outside storage, which is a necessary practice in a JIT operational environment.

Additionally, the knowledge that planners have concerning how to plan for logistics firms limited, as evidenced by a recent study (Haider, 2010). The large gaps in the knowledge of planning staff can be overcome in part by creating and implementing land use guidelines. The guidelines introduced by Gordon (2005) have been submitted to the Ontario Ministry of Transportation, the following suggestions could enhance and add to the knowledge inherent in the proposed freight supportive land-use guidelines:

- Identification and protection of corridors that are significant for freight traffic on municipal roads and ensuring 24/7 freight operations on these corridors
- Ensuring 24/7 operational environments when planning for industrial zones
- Re-evaluation of aesthetic considerations in industrial zones to incorporate and allow more trailer parking on site as necessary for a JIT environment
- Re-evaluation of auto parking requirements

5.4.2 Parking Strategy Recommendation

There is a specific strategy that will be suggested that may help to alleviate issues with parking within industrial zones. A shared parking zone could be created that would allow industrial parks to be clustered around large, shared parking lots that could act as a 'square' within the industrial area. Having auto parking available off the actual lot itself would provide flexibility for firms to utilize more of their lot for their business operations. Motivation for this strategy can be seen in Figure 5-1, photos that were taken by the author on Monday, July 12,

2010. The first photo is of Royal Touch foods, a food manufacturer and distributor in Etobicoke, ON. It can be seen that because of the labour intensive nature of their products, a great number of people are employed at this plant and parking is so scarce that employees are forced to park up and down the building. This is in contrast to the second photo of the side of the building of Reckitt Benckiser in Milton, ON, a consumer goods company with a very large warehouse. Here, the parking lot is nearly empty. Assuming that businesses like these are located in the same area, a shared parking area would have benefits of increasing the efficiency of each operation, while ensuring that over the long run there would not be problems with parking on the street.

Figure 5-1: Royal Touch Foods, Etobicoke, ON (left) and Reckitt Benckiser, Milton, ON (right)

Photos taken by author on July 12, 2010

Key Recommendations:	• **Emphasizing the importance of 24/7 operations in freight supportive land use guidelines** • **Development of a shared parking strategy** • **Modification of MOE D-6 land use guidelines**

5.5 Long Combination Vehicles

Finally, Long Combination Vehicles have not been mentioned throughout the literature that has been reviewed as a factor influencing the location choices of logistics firms. This study has taken place as a pilot project allowing 100 LCV permits are issued within Ontario, but these vehicle combinations have been operated in other jurisdictions in Canada for periods of time

ranging from years to decades. In spite of the fact that LCVs had just finished their first pilot season in Ontario (summer of 2009), many of the respondents were aware of the potential of these vehicles. All but one of the participants in the interview portion had either no use for the vehicle combination, or had reservations about the use of LCVs. However, the survey results showed that LCVs were being used by participants, although they are not that an important consideration for making a location choice. If the LCV program is long lived in Ontario, then another survey after LCVs have been well established within Ontario would be an interesting longitudinal contribution to the literature.

Key Finding:	• **Long Combination Vehicles may become a more important operational consideration for larger firms, but are not likely to become an important location factor**

The findings suggest that in the future LCVs will not be a very important location factor for most logistics businesses. The survey results suggest that although firms are interested in utilizing these vehicle combinations, they are not as willing to pay for ingress/egress improvements that would permit greater use of LCVs. A role for the public sector may be in creating staging areas on limited access highways as is done in New York State. This option could be investigated in the Canadian context to allow more firms to have access to utilizing LCVs.

5.6 Summary of Findings

The relative importance of location factors has been addressed throughout the results of this thesis. Several unique findings have been made that have added to the body of knowledge that exists regarding the location choices of logistics firms. As well, findings have confirmed knowledge about the logistics industry to a large extent, and explored Canadian nuances. The differing structure of the logistics industry within various regions within Canada has been discussed. The identification of issues of interest to Canadian planners has been identified, and the emergence of Long Combination Vehicles in Ontario as a location factor has been explored.

These findings have implications for a number of groups. First, within academic literature this is the first attempt to classify location factors influencing logistics firms within Canada. For urban planners, who are becoming more cognizant of taking into account the needs of the logistics industry this study has identified deficiencies in the planning process and results

could be incorporated into goods movement plans that are currently being undertaken by Canadian municipalities. For logistics firms and industrial land speculators, this study consolidates views of the industry and provides a tool to effectively lobby municipal and provincial governments to ensure proper operating environments within Canadian communities.

5.7 Future Work

There are several avenues of research that can build upon this thesis. Specific to logistics locations, the growth of logistics businesses in and around certain areas can be explored. This could include the investigation of the growth of logistics firms around intermodal facilities, or the growth of intermodal facilities in general. Massive new intermodal facilities are being constructed around North America including in Winnipeg, Calgary, and Regina, and the effect that they are having upon supply chains could be of interest for further research. Another specific area that would be interesting to examine is the role of gateways in northern Canada serving as logistics hubs. How they operate, how they have evolved, and what are the types of logistics businesses that use these northern centres as bases for keeping the north supplied.

This work could be accomplished through a more detailed look into the data used for the Logistics Landscape chapter in this thesis and drill down into more detail. Examine businesses at the three digit NAICS level and try to obtain more detailed data on the locations of businesses. Accomplishing this would begin to give policy makers a more detailed understanding of how goods flow through Canadian regions.

Of course, this work could be undertaken with a larger, more representative sample, soliciting more responses. This would enable future researchers to not only compare these results over time, but also to be able to break down responses by type of business operation for example, to obtain more detailed results on different subsectors of the logistics industry. Additionally, investigation of the effects of LCVs on the logistics industry over the next 10 or more years would be an interesting comparison to these results.

A question that came up through undertaking this research was the relationship of the costs of the supply chain with the number of warehouses that exist within a particular supply chain and the effectiveness of that particular supply chain to become more or less responsive. These trade-offs are not usually examined in the literature, and they will have an effect on the

structure of supply chains and their environmental impact, either in terms of transportation effects or more land being used for logistics operations. (Bentz, Simchi-Levi, & Gosier, 2008) give an example of how supply chains will be restructured if fuel prices rise by certain amounts. Relationships like these should be more understood by policy makers to help them influence supply chains in a way that can meet societal goals.

5.8 Conclusion

This thesis has presented findings that show the relative importance of location factors to logistics firms. Through analysis of Statistics Canada data, the general locations and importance of the logistics industry has been outlined. The surveys administered to logistics professionals and interviews with these individuals have also helped to answer secondary research questions, those concentrating on planning aspects, and concerning the impacts that LCV adoption may have upon the location choices of firms.

The methodology used to classify various location factors according to hypothesized effects appears to be transferrable to other studies and useful for location studies in general. The relative importance of location factors has allowed implications for planners and economic development officers to be identified that will help these groups in better accommodating and attracting logistics firms to communities.

Specific findings have included the importance of site specific location factors to logistics firms, especially larger firms. The need for a robust operational environment has built upon the findings within the literature, but emphasized the importance of this location factor. Additionally, this thesis has found that the development and provision of freight supportive land use guidelines should be implemented, as the same problems concerning trailer parking, truck staging areas are reoccurring over the past ten years within southern Ontario. That the provision of multi-modal infrastructures is only important at the regional level is useful for developers of these infrastructures, as they need to consider that they will have to make their sites attractive to gain interest from a wide variety of logistics industry players. In addition to the development of freight supportive land use guidelines, another recommendation is to investigate how logistics campuses can be developed and supported.

However, in spite of the fact that there have been limited planning efforts traditionally to incorporate goods movements into the planning process (Rodrigue, 2006), and that planners are not aware of how the logistics industry operates (Haider, 2010), there has recently been more attention begun to be paid to goods movements within the Greater Toronto Area. As referenced throughout the thesis, the Central Ontario Goods movement study has provided many directions that could be taken by governments to further incorporate goods movements into the planning process (iTrans Consulting, 2004). Several regional municipalities within the region have begun to prepare plans for freight movements (Transport Canada Urban Goods Workshop, Toronto, March 9/10, Unpublished Data) as well as the new regional transportation authority, Metrolinx (2008). The extent to which these plans will incorporate the siting of logistics facilities is yet to be seen; however, increasing interest in goods movements by governments may reverse the trend of leaving goods movement out of planning efforts.

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Appendix A – Methods

A.1 Interview Schedule

Interview Script (Jakubicek, Paul)

Project: Understanding Location Choices of Logistics Firms

Scope

1. **What scope of area do logistics firms look at when choosing to serve a Canadian metropolitan area?**
2. **What are the factors that affect the attractiveness of your region as opposed to other urban regions?**

Prompts:

3. How do you make the decision to serve a particular area? Do you look being at the centre of your customers and then find an appropriate site?

4. When choosing between a more established versus an expanding city that is on the outskirts, what are the types of trade-offs that you make? Is there a benefit for being located within Mississauga versus Guelph or Cambridge?/Vancouver versus Langley? /Calgary versus Airdrie or Red Deer?

Network Design

5. **How does a firm decide on the number of DCs within its network?**

Prompts:

6. Do you foresee your firm increasing or decreasing the number of facilities in its distribution network? If so what are the reasons for these changes?
7. Do fuel prices/fuel price volatility have a role to play in changing the number of DCs? Or does your firm look at the travel times to your customers and give them more weight then distance?
8. Is (congestion/Hours of Service/other) a factor in changing the locations of your DCs?
9. Is consolidation of facilities/expansion of more facilities of your network desirable today for reasons other than serving more or less customers?
10. For 3PLs: Is the number of DCs in your network driven by acquiring new customers?

11. What are the decision-making processes at play?

Prompts:

12. How did the actual site selection process take place? Did you sit down with various people in your organization and decide on what you want? How was the decision made?
13. Does your firm use a formal decision-making process like MCDM or AHP? Or is the decision simply made by the CEO, etc?
14. Did you estimate your transportation costs if you looked at a particular location, versus another one in the same region?
15. For 3PLs: do you locate based on one customer's considerations mostly; do you handle more then one customer's product in the same warehouse, if your major customer has a significant change in their supply chain will your facility be useless? How do you deal with this uncertainty in terms of your facility locations, by holding short leases on facilities?

Site Considerations/Location Factors

16. What are dominant site characteristic needs?

Prompts:

17. Is access to highways important? Do you use intermodal facilities? If so, are the goods that move through multi-modal facilities time sensitive or are they mostly inbound transport that isn't time sensitive?
18. How important are high land costs in pushing you away from a core area, conversely, low land costs pulling you towards a peripheral area? Are there other considerations that are more important?
19. What are the trade-offs between renting space, outsourcing and building-to-suit your own building? How does the planning horizon and type of business affect this decision?
20. If your site is space constrained, then what will push you over the edge to move to a new site?

21.How important are labour availability needs?

Prompts:

22. Is there a trend to having fewer people employed and more automation of processes within a warehouse? Is the industry becoming more productive because of this?
23. How important is your labour pool in preventing you from moving?

24. What your tendencies in terms of locating next to other similar firms?

Prompts:

25. Do you locate away from other firms to avoid congestion? Or do you locate close to other firms to take advantage of proximity to a customer base?
26. Some literature points to the fact that distribution firms locate close together to take advantage of skilled labour. Other literature points out that congestion around major generators of freight traffic causes distribution firms to be farther apart. Which trend, if any do you see as being prevalent?

Dealing with Governments

27. What would draw you to a particular city above another?

28. Are some municipalities seen as 'friendlier' than others?

Prompts:

29. What would be your wish list that a municipality could offer you in order to entice you to locate there? Taxes? Working with you to understand and accommodate your needs in terms of your site design? Like wider driveways, bylaws that cause problems?
30. Have you ever been approached by a city/government to discuss the merits of locating within their municipality?

Long Combination Vehicles

31. ON/NS/NB/possibly BC: Do you anticipate further/or more pronounced clustering of distribution firms around MTO approved LCV routes to take advantage of these vehicle combinations?

Prompts:

32. Would your firm consider relocating if cost-savings could be at LCV accessible locations because of their use?
33. Would you be willing to pay for ingress/egress improvements in order to accommodate these vehicle combinations?
    - To your site?
    - On public roads?

Participants that are located in the Prairie provinces, where LCV use as generally been established for quite some time, questions will seek to understand to what extent, if any LCV use has had upon the location decisions of firms.

Future Trends

34. What do you see as future trends for the location of distribution firms?

Prompts:

35. Will more extremely large facilities continue to be built?
36. Will cities with large amounts of facilities, like Mississauga, lose distribution firms to places like Brantford/Cambridge?
37. Will intermodal transportation play a greater role in the future?
38. Will there be a trend towards more numerous and smaller facilities because of possible increasing fuel prices?

A.2 Survey Instrument

Question Number	Main Question	Question	Possible Responses					
1		RespondentID						
2		CollectorID		CIFFA Collector	Logistics-Survey Collector			
3		Street						
4		City, Province						
5		Postal Code						
6	Type of Company: (check all that apply)	Asset Based 3PL		No	Asset Based 3PL			
7		Non Asset Based 3PL		No	Non Asset Based 3PL			
8		Private Carrier		No	Private Carrier			
9		For-Hire Carrier		No	For-Hire Carrier			
10		LTL Carrier		No	LTL Carrier			
11		Manufacturer		No	Manufacturer			
12		Facility Operator/Public Warehouse		No	Facility Operator/Public Warehouse			
13		Freight Forwarder		No	Freight Forwarder			
14		Distributor		No	Distributor			
15		Number of Employees:	No Employees	1-4 Employees	5-9 Employees	10-19 Employees	20-49 Employees	50-99 Employees
			100-199 Employees	200-499 Employees	500 plus Employees			
16		Number of Employees involved in Transportation and Warehousing Operations:	No Employees	1-4 Employees	5-9 Employees	10-19 Employees	20-49 Employees	50-99 Employees

			100-199 Employees	200-499 Employees	500 plus Employees			
17		If you operate your own fleet of trucks, how many trucks do you operate?						
18		What is the square footage of your facility?		Up to 20,000 sqft	20,001 to 100,000 sqft	100,001 to 500,000 sqft	500,001 to 1 million sqft	More then 1 million sqft
19	How many dock doors does your facility have?	Truck dock doors						
20		Drive in doors						
21		Rail Car doors						
22		How long have you been at your current facility?		Up to 5 years	5-10 years	10-20 years	More then 20 years	
23		How far ahead does your firm's strategic plan look, in terms of your facility needs?		Up to 5 years	5-10 years	10-20 years	More then 20 years	
24		How long do you think your facility will meet your needs before you are forced to move?		Up to 5 years	5-10 years	10-20 years	More then 20 years	
25	Are there any zoning/operational issues that impact your business that you would like to see addressed?	Problems with neighbours complaining of excessive noise		No	Problems with neighbours complaining of excessive noise			
26		No Truck Routes		No	No Truck Routes			
27		Operating Restrictions at night		No	Operating Restrictions at night			

28		Too many auto parking spots required by bylaws		No	Too many auto parking spots required by bylaws			
29		Problems with parked trailers classified as outside storage		No	Problems with parked trailers classified as outside storage			
30	LCVs	Does your firm, or the carriers that you use, utilize LCVs?		Yes	No			
31		Would you be willing to provide Ingress/Egress Improvements to your site?		Yes	No			
32		Would you be willing to provide space on your site for staging these vehicle combinations?		Yes	No			
33	Site Characteristics	Land available for expansion - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
34		Land available for expansion - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
35		Number of dock doors - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
36		Number of dock doors - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent

37	Accessibility	Proximity to Highways - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
38		Proximity to Highways - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
39		Public Transit Availability - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
40		Public Transit Availability - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
41		Long Combination Vehicle Accessibility - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
42		Long Combination Vehicle Accessibility - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
43		Access to major customers - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
44		Access to major customers - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent

45		Access to major suppliers - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
46		Access to major suppliers - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
47		Airport - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
48		Airport - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
49		Sea Port - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
50		Sea Port - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
51		Rail Intermodal Facility - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
52		Rail Intermodal Facility - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
53	Zoning/Operational Requirements	Ability to operate 24/7 - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
54		Ability to operate 24/7 - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent

55		Trailer Parking - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
56		Trailer Parking - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
57		Truck Staging Areas - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
58		Truck Staging Areas - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
59		Highway Visibility - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
60		Highway Visibility - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
61	Labour	Availability of Skilled Workers - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
62		Availability of Skilled Workers - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
63	Economic/Business Factors	Availability of Unskilled Workers - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important

64		Availability of Unskilled Workers - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
65	Business Activities	Pro-business regulatory environment - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
66		Proximity to other similar businesses - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
67		Low land costs/tax rates - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
68		Low land costs/tax rates - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
69		Proximity to other similar businesses - Importance of this Factor to your Business		Not Important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
70		Proximity to other similar businesses - Extent to which your Current location addresses this factor		Not at all	Somewhat	Adequately	More than Adequate	Excellent
71	What type of logistics activities do you perform? (Check all that apply)	What would you describe your primary business activity as?		Manufacturing	Warehousing	Research and Development	Distribution	Freight Forwarding/Brokerage

72		Labeling		No	Yes			
73		Breaking Bulk		No	Yes			
74		Inventory control and Management		No	Yes			
75		Light assembly		No	Yes			
76		Order entry and fulfillment		No	Yes			
77		Packaging		No	Yes			
78		Pick and pack		No	Yes			
79		Price marking and ticketing		No	Yes			
80		Transportation arrangement		No	Yes			
81		Cross Docking		No	Yes			
82		What is your North American Industrial Classification System (NAICS) Classification?		Not Sure	411 - Farm Product Wholesaler-Distributors	412 - Petroleum Product Wholesaler-Distributors	413 - Food and Beverage Wholesaler-Distributors	414 - Personal and Household Goods Wholesaler-Distributors
				415 - Motor Vehicle and Parts Wholesaler-Distributors	416 - Building Material and Supplies Wholesaler-Distributors	417 - Machinery, Equipment and Supplies Wholesaler-Distributors	418 - Miscellaneous Wholesaler-Distributors	419 - Wholesale Electronic Markets and Agents and Brokers
				481 - Air Transportation	482 - Rail Transportation	483 - Water Transportation	484 - Truck Transportation	4885 - Freight Transport Arrangement
				491 - Postal Service	492 - Couriers and Messengers	493 - Warehousing and Storage		

Appendix B – Results

Figure 5-2: Table of CMA Growth Rates

	Number of Firms per 1000 residents				Growth Rate between 1999 and 2008	
CMA Name	*NAICS 48&49 - 1999*	*NAICS 48&49 - 2008*	*NAICS 41 - 2008*	*NAICS 41 - 2008*	*NAICS 48&49*	*NAICS 41*
Edmonton, Alberta	4.14	4.64	4.21	3.44	0.35	-0.02
Abbotsford-Mission, BC	4.09	7.41	2.71	2.95	1.01	0.21
Saskatoon, Saskatchewan	4.06	4.03	3.87	3.20	0.08	-0.10
Calgary, Alberta	3.42	3.89	4.86	3.80	0.45	0.00
Regina, Saskatchewan	3.33	3.16	3.22	2.76	-0.01	-0.11
Winnipeg, Manitoba	3.25	3.22	3.81	3.02	0.06	-0.15
Vancouver, British Columbia	3.19	4.14	5.86	5.13	0.46	-0.01
Thunder Bay, Ontario	3.08	2.85	2.40	2.28	-0.10	-0.07
Saguenay, Quebec	2.81	2.34	2.71	2.11	-0.21	-0.26
Quebec, Quebec	2.70	2.59	3.50	2.67	0.03	-0.18
Montréal, Quebec	2.63	2.74	5.36	4.14	0.14	-0.16
St. John's, NL	2.61	2.21	3.74	2.82	-0.10	-0.20
Sherbrooke, Quebec	2.57	2.52	3.33	2.65	0.22	-0.01
Kitchener, Ontario	2.54	3.55	3.54	3.21	0.62	0.05
Saint John, New Brunswick	2.52	2.56	2.45	2.22	0.01	-0.10
Toronto, Ontario	2.29	4.57	5.24	4.65	1.37	0.06
Greater Sudbury, Ontario	2.24	2.03	2.89	2.72	-0.09	-0.05
Trois-Rivières, Quebec	2.19	2.26	2.50	2.24	0.06	-0.08
Hamilton, Ontario	2.15	3.09	3.14	2.98	0.58	0.04
London, Ontario	2.05	2.76	3.07	2.74	0.48	-0.02
Victoria, British Columbia	2.02	2.46	2.54	2.38	0.33	0.02
Windsor, Ontario	2.01	3.18	2.10	1.88	0.71	-0.03
St. Catharines-Niagara, Ontario	2.00	2.32	2.52	2.34	0.21	-0.03
Halifax, Nova Scotia	1.99	2.37	3.86	3.12	0.29	-0.12
Oshawa, Ontario	1.79	1.98	2.08	1.76	0.34	0.02
Kingston, Ontario	1.79	1.93	1.97	1.91	0.12	0.01
Ottawa-Gatineau, Ontario/Quebec	1.58	1.70	2.31	1.79	0.22	-0.12
Note:CMAs 521 and 932 use 2001 pop for 1999						

Table 5-2: Matched Pair t-test - All results

			Paired Differences				
	Importance Mean	Satisfaction Mean	Mean	t	df	Sig. (2-tailed)	McNemar's Test
Low land costs/tax rates	3.95	2.78	1.22	6.221	40	0	0.000
Land available for expansion	2.59	2.1	0.571	2.345	41	0.024	0.146
Number of dock doors	3.33	2.95	0.429	2.253	41	0.03	0.027
Pro-business regulatory environment	3.45	3.05	0.4	2.576	39	0.014	0.013
Availability of Skilled Workers	3.73	3.33	0.395	2.647	42	0.011	0.004
Ability to operate 24/7	3.82	4.07	-0.214	-1.055	41	0.298	1.000
Proximity to Highways	3.75	3.88	-0.116	-0.777	42	0.441	0.727
Access to major customers	3.55	3.57	0	0	41	1	0.143
Trailer Parking	3.34	3.33	0.119	0.573	41	0.57	0.022
Access to major suppliers	3.3	3.6	-0.256	-1.45	42	0.154	0.581
Truck Staging Areas	3.09	3.02	0.167	0.747	41	0.46	0.035
Public Transit Availability	2.93	2.93	0	0	42	1	1.000
Sea Port	2.26	2.57	-0.286	-1.576	41	0.123	1.000
Long Combination Vehicle Accessibility	2.21	2.57	-0.333	-1.827	41	0.075	0.727
Rail Intermodal Facility	2.51	2.95	-0.39	-2.389	40	0.022	1.000
Availability of Unskilled Workers	2.61	3.02	-0.405	-2.006	41	0.052	1.000
Airport	2.88	3.45	-0.595	-2.909	41	0.006	0.267
Highway Visibility	2.14	2.83	-0.643	-3.344	41	0.002	0.109
Proximity to other similar businesses	2.25	3.07	-0.786	-4.172	41	0	0.344

Table 5-3: Matched Pair t-test - Small Firms

			Paired Differences				
Small Firms (those with under 100,000sqft)	Importance Mean	Satisfaction Mean	Mean	t	df	Sig. (2-tailed)	McNemar's Test
Low land costs/tax rates	4.05	2.60	1.550	5.616	19	.000	.001
Availability of Skilled Workers	3.82	3.10	.714	3.101	20	.006	.021
Pro-business regulatory environment	3.43	2.84	.579	2.251	18	.037	.125
Proximity to Highways	3.73	4.00	-.238	-1.227	20	.234	1.000
Ability to operate 24/7	3.59	4.00	-.350	-1.000	19	.330	1.000
Access to major suppliers	3.36	3.62	-.143	-.645	20	.526	.219
Access to major customers	3.32	3.45	-.100	-.462	19	.649	.219
Airport	3.27	3.71	-.476	-1.451	20	.162	1.000
Trailer Parking	2.91	3.00	.100	.282	19	.781	.687
Number of dock doors	2.86	2.65	.300	.972	19	.343	.227
Truck Staging Areas	2.77	2.90	.050	.134	19	.895	.016
Public Transit Availability	2.77	2.86	-.095	-.317	20	.754	1.000
Land available for expansion	2.36	2.05	.450	1.143	19	.267	1.000
Availability of Unskilled Workers	2.32	2.85	-.550	-1.446	19	.164	.727
Sea Port	2.18	2.76	-.524	-2.057	20	.053	.625
Long Combination Vehicle Accessibility	1.86	2.55	-.650	-2.156	19	.044	.375
Highway Visibility	2.05	2.85	-.700	-2.208	19	.040	.625
Proximity to other similar businesses	2.27	3.10	-.750	-2.263	19	.036	.375
Rail Intermodal Facility	2.23	3.10	-.800	-3.107	19	.006	.500

Table 5-4: Matched Pair t-test - Large Firms

			Paired Differences				
Large Firms (those with over 100,000sqft)	Importance Mean	Satisfaction Mean	Mean	t	df	Sig. (2-tailed)	McNemar's Test
Low land costs/tax rates	3.86	2.95	0.90	3.40	20	0.00	0.006
Number of dock doors	3.77	3.23	0.55	2.32	21	0.03	0.109
Land available for expansion	2.82	2.14	0.68	2.24	21	0.04	0.063
Ability to operate 24/7	4.05	4.14	-0.09	-0.40	21	0.69	0.687
Trailer Parking	3.77	3.64	0.14	0.57	21	0.58	0.016
Access to major customers	3.77	3.68	0.09	0.49	21	0.63	0.549
Proximity to Highways	3.77	3.77	0.00	0.00	21	1.00	1.000
Availability of Skilled Workers	3.64	3.55	0.09	0.53	21	0.60	0.180
Pro-business regulatory environment	3.48	3.24	0.24	1.31	20	0.20	0.109
Truck Staging Areas	3.41	3.14	0.27	1.03	21	0.31	0.016
Access to major suppliers	3.23	3.59	-0.36	-1.32	21	0.20	1.000
Public Transit Availability	3.09	3.00	0.09	0.40	21	0.69	1.000
Availability of Unskilled Workers	2.91	3.18	-0.27	-1.55	21	0.14	0.375
Rail Intermodal Facility	2.81	2.81	0.00	0.00	20	1.00	0.250
Long Combination Vehicle Accessibility	2.55	2.59	-0.05	-0.22	21	0.82	1.000
Sea Port	2.33	2.38	-0.05	-0.19	20	0.85	1.000
Highway Visibility	2.23	2.82	-0.59	-2.52	21	0.02	0.219
Airport	2.48	3.19	-0.71	-2.86	20	0.01	0.125
Proximity to other similar businesses	2.23	3.05	-0.82	-4.01	21	0.00	1.000

Table 5-5: Cross Tabulation Results

Compares whether respondents will move within 5 years or more Versus ranked Important or Very Important or not	Pearson Chi-Square	Fisher's Exact Test		
	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Notes
Land available for expansion - Importance of this Factor to your Business	0.217	0.73	0.45	a
Land available for expansion - Extent to which your Current location addresses this factor	1.346	0.34	0.25	b
Number of dock doors - Importance of this Factor to your Business	0.033	1.00	0.56	
Number of dock doors - Extent to which your Current location addresses this factor	5.468	0.04	0.02	
Proximity to Highways - Importance of this Factor to your Business	2.978	0.11	0.08	
Proximity to Highways - Extent to which your Current location addresses this factor	2.669	0.12	0.10	
Public Transit Availability - Importance of this Factor to your Business	0.268	0.73	0.44	a
Public Transit Availability - Extent to which your Current location addresses this factor	0.02	1.00	0.58	a
Long Combination Vehicle Accessibility - Importance of this Factor to your Business	1.363	0.38	0.24	b
Long Combination Vehicle Accessibility - Extent to which your Current location addresses this factor	2.877	0.12	0.10	a
Access to major customers - Importance of this Factor to your Business	5.622	0.03	0.02	
Access to major customers - Extent to which your Current location addresses this factor	1.073	0.35	0.24	
Access to major suppliers - Importance of this Factor to your Business	1.422	0.35	0.19	
Access to major suppliers - Extent to which your Current location addresses this factor	2.569	0.19	0.10	
Airport - Importance of this Factor to your Business	0.973	0.35	0.25	
Airport - Extent to which your Current location addresses this factor	0.141	0.76	0.48	
Sea Port - Importance of this Factor to your Business	0.001	1.00	0.63	a
Sea Port - Extent to which your Current location addresses this factor	1.522	0.29	0.19	a
Rail Intermodal Facility - Importance of this Factor to your Business	0.105	1.00	0.52	a
Rail Intermodal Facility - Extent to which your Current location addresses this factor	0.889	0.46	0.28	a
Ability to operate 24/7 - Importance of this Factor to your Business	1.393	0.30	0.20	
Ability to operate 24/7 - Extent to which your Current location addresses this factor	2.09	0.27	0.14	
Trailer Parking - Importance of this Factor to your Business	0.094	1.00	0.50	a
Trailer Parking - Extent to which your Current location addresses this factor	0.322	0.74	0.41	a
Truck Staging Areas - Importance of this Factor to your Business	0.66	0.54	0.31	
Truck Staging Areas - Extent to which your Current location addresses this factor	1.497	0.30	0.19	a
Highway Visibility - Importance of this Factor to your Business	0.183	1.00	0.49	a
Highway Visibility - Extent to which your Current location addresses this factor	0.108	1.00	0.51	
Availability of Skilled Workers - Importance of this Factor to your Business	0.009	1.00	0.60	
Availability of Skilled Workers - Extent to which your Current location addresses this factor	0.514	0.53	0.35	
Availability of Unskilled Workers - Importance of this Factor to your Business	0.009	1.00	0.60	
Availability of Unskilled Workers - Extent to which your Current location addresses this factor	0.51	0.49	0.36	a
Pro-business regulatory environment - Importance of this Factor to your Business	0.475	0.54	0.35	
Pro-business regulatory environment - Extent to which your Current location addresses this factor	0.32	0.71	0.43	a
Low land costs/tax rates - Importance of this Factor to your Business	0.763	0.49	0.30	a
Low land costs/tax rates - Extent to which your Current location addresses this factor	0.143	0.69	0.51	b
Proximity to other similar businesses - Importance of this Factor to your Business	0.115	1.00	0.51	a
Proximity to other similar businesses - Extent to which your Current location addresses this factor	0.189	0.73	0.46	a

Notes a: 1 cell has an expected count of less than 5
b: 2 cells have an expected count of less than 5